



Title	Summary International Reports, July 1981-June 1982
Citation	Memoirs of the Faculty of Engineering, Hokkaido University, 16(1), 33-66
Issue Date	1982-12
Doc URL	http://hdl.handle.net/2115/38002
Type	bulletin (other)
File Information	16(1)_33-66.pdf



[Instructions for use](#)

The Sixth International Conference on
Port and Ocean Engineering under Arc-
tic Conditions Quebec, Canada, July 27-
31, 1981

EXPERIMENTAL STUDY ON FLEXURAL STRENGTH AND ELASTIC MODULUS OF SEA ICE

Hiroshi SAEKI*, Akira OZAKI* and Yoshimitsu KUBO**

*Department of Civil Engineering, Hokkaido University, and **CR Engineering Laboratory, Japan

The purpose of present investigation is to clarify the difference in flexural strength and elastic modulus of sea ice which is produced by the difference in testing method and testing scale. Three kinds of testing methods on flexural strength and elastic modulus were carried out in different scales (small-scale test, intermediate-scale test and large-scale test). The results of this study may be stated as follows:

- (1) Poisson's ratio of sea ice in southern Okhotsk sea changed with the stress rate.
- (2) The deflection curve and bearing capacity of ice sheet calculated from Kubo's theory agreed with the test results before the occurrence of initial cracks.
- (3) The flexural strength and elastic modulus obtained from small-scale tests showed larger values in comparison with the values obtained from other tests at the same stress rate.
- (4) The flexural strength and elastic modulus obtained from insitu cantilever test (intermediate-scale test) agreed well with the values obtained from bearing capacity test in the field (large-scale test) at the same stress rate.

International Symposium on Ice (IAHR)
Quebec, Canada, July 27-31, 1981

MECHANICAL PROPERTIES OF ADHESION STRENGTH TO PILE STRUCTURES

Hiroshi SAEKI, Toshiyuki ONO and Akira OZAKI

Department of Civil Engineering, Hokkaido University, Japan

Systematic tests were carried out to clarify the effects of push-out speed, stress rate, ice thickness, pile diameter, material of pile and ice temperature on adhesion strength of sea ice to piles by means of push-out test. Steel piles and concrete piles with diameters 3.15, 5.0, 10.0 and 15.0cm were used in ice thickness from 1.0 to 13.0cm at a moderately high ice temperature ranging from -1.5°C to -4.3°C .

Adhesion strength to piles was observed to have a peak value with changes of push-out speed and stress rate. Adhesion strength increased with increasing ice thickness and roughness of pile surface and also increased with decreasing pile diameter and ice temperature.

Third International Earthquake Micro-
zonation Conference, June 28-July 1, 1982
Seattle, Washington, U.S.A.

AN AUTOMATIC DRAWING TECHNIQUE OF CONTOUR MAPS OF SEISMIC INTENSITY AND OTHER SPATIALLY DISTRIBUTED EARTHQUAKE ENGINEERING DATA

Yutaka OHTA and Hiroshi KAGAMI
Dept. of Architectural Engineering, Hokkaido University

An objective method is proposed for an automatic drawing of contour maps from intermittently distributed earthquake engineering data, by revising the Trend Surface Analysis technique developed in Geography.

To grasp the general pattern of spatial distribution of certain earthquake-related data plays an important role in the early stages of earthquake engineering research.

Seismic intensities, damage ratios, maximum recorded accelerations etc. are often drawn on contour maps. However, no well-developed method for smoothing spatial data in earthquake engineering has been known and therefore contour maps are apt to be drawn arbitrarily.

The Trend Surface Analysis based principally upon the least squares method is a multi-degree surface fitting technique for spatially distributed data. This technique was revised in such a way that the smoothing can be objectively performed and contour maps can be automatically drawn. Applying this developed technique to various earthquake engineering data, more precise and objective isoseismal maps, damage ratio distribution maps and so on can be obtained.

From these pilot experiments one can conclude that the technique proposed here is a powerful tool for making it possible to analyze objectively a large amount of various data in earthquake engineering.

Third International Earthquake Micro-
zonation Conference, June 28-July 1, 1982
Seattle, Washington, U.S.A.

STRATEGY FOR SITE PLANNING OF OUT-DOOR REFUGE PLACES SAFE FROM WIDE-SPREADING FIRES DUE TO A LARGE EARTHQUAKE

Hiroshi KAGAMI and Yutaka OHTA
Dept. of Architectural Engineering, Hokkaido University

An algorithm for optimal disposition findings of out-door refuge places from wide-spreading earthquake fires is proposed by an application of Linear Programming Method (Transportation Problem).

In this paper it is formulated that the residents are assigned to a certain refuge place with limited capacity so that the total traveling distance of whole population is minimized.

This can be equated with the Transportation Problem in Linear Programming Method. By solving this problem the distribution of traveling distance of each refugee to an assigned refuge

place is obtained, and therefore an evaluation of propriety in disposition and size of the refuge place can be made in comparison with the critical distance in which citizens may safely reach against the violence of earthquake disasters.

An actual city with a population of 1 million was tested in this manner. An extension of the technique to simultaneous consideration of such as seismic microzonation and land use characteristics was also made through this case study.

Finally, disposition and size of the ready-made refuge places in this city are criticized and many defects that require improving are pointed out.

2nd World Congress of Chemical Engineering Montreal, Canada 1981 October
4-9

THE BEHAVIORS OF REFRACTORY METABOLITES FROM AEROBIC BIOLOGICAL PROCESSES

N. TAMBO and T. KAMEI

Department of Sanitary Engineering

In the evaluation of the treatability of various types of treatment processes, it is very often important to take certain types of by-product formation into account. Here generation and effects of biochemically refractory compounds excreted from aerobic-biological processes are presented.

The authors had carried experimental studies i) to identify the amount of metabolites obtainable from the treatment of various types of organic compounds by the mixture of aquatic microorganisms such as activated sludge, ii) to identify the influence of such metabolites on the biological treatability, iii) to characterize the metabolites obtained from the treatment of various types of substrate by activated sludge in relation to natural colored water, and iv) to characterize THM formation potential of the substances by chlorination.

By the studies, vast quantitative informations were revealed with respect to the nature and behaviors of the metabolites excreted from the complex mixture of miscellaneous microorganisms such as activated sludge.

International Symposium on Weak Rock, September 21-24, 1981, Tokyo, Japan

Coal Mine Roadway Stability in Massive Shale

Yoji ISHIJIMA*, Shigenori KINOSHITA*, Masaru SATO** and Atsushi FUKUSHIMA***

*Faculty of Engineering, Hokkaido University, Sapporo, Japan

**Taisei Corp., Tokyo, Japan

***Coal Mining Research Center, Tokyo, Japan

Yubari New Coal Mine has been suffering from roadway maintenance problems. The Behavior of the main roadways which consists of layers of Horokabetsu shale are characterized by the

continuing creep-like deformation with a considerable amount of closure rate which depends on the water content of rock mass.

As a first step of this case study, many field measurements were conducted to clarify the mechanism of the excessive roadway deformation.

As a next step, physical scale model tests were performed to obtain a guideline on the design of the supporting system.

Some effective supporting systems supplemented with the numerical model study are examined in the field tests, in which several combined methods of bolting and shotcreting are adopted.

An additional testing project will be conducted in the near future aiming to reinforcing the rock mass effectively before it undergoes such a deterioration that would be uncontrollable.

International Symposium on Weak
Rock, September 21-24, 1981, Tokyo,
Japan

A Study on Water-sensitivity of Argillaceous Rock

Toshiro SASAKI*, Shigenori KINOSHITA** and Yoji ISHIJIMA**

*Nippon Koei Co. Ltd., Tokyo, Japan

**Faculty of Engineering, Hokkaido University, Sapporo, Japan

There are many case studies which show the close relation between the degree of maintenance of the openings formed in the argillaceous rock mass and their moisture conditions.

In this paper, some important aspects of water-sensitive properties obtained by using moisture controlled rock samples are given. Particular attention is paid to the mechanism of strength dependency on moisture change of the argillaceous rocks in unsaturated conditions.

It is shown that two indexes (one is the adsorptive capacity of Methylene Blue and the other is change in free energy due to moisture fluctuation) have been shown to provide good criteria of the degree of water-sensitivities of argillaceous rocks which are characterized by the three aspects of swelling, slaking and strength reduction.

The former, which is easy to measure, can be used as an index for classifying the argillaceous rocks in terms of water-sensitivity.

The latter, which needs the data of the moisture characteristic curve of evaluate, offers also similar, but a more quantitative index. In addition, the concept of the change in free energy could provide useful information to develop a better understanding of moisture enhanced strength reduction.

Third Conference on Acoustic Emission/
Microseismic Activity in Geologic Structures and Materials, October 5-7, 1981

Acoustic Emission During Advance Boring Associated with the Prevention of Coal and Gas Outbursts

Iwao NAKAJIMA, Yoshiteru WATANABE
Mining Machinery, Department of Mineral Resources Development Engineering
and Tetsu FUKAI
The Coal Mining Research Centre

In this research, the fracturing activity in coal seam during advance boring was observed by applying the acoustic emission technique in order to ascertain its preventive effect on coal and gas outbursts.

At the test sites, two transducers were installed at some distance along prearranged boreholes. The detected signals associated with coal fractures were separated from drilling noises, and presented for the analyses on the parameters of acoustic emission activities and their one-dimensional source locations.

As a result, it was confirmed that these observational results offered sufficient information to estimate the effect of relaxation to coal seam by boring and to determine the location of a local stress concentration.

Third Conference on Acoustic Emission/
Microseismic Activity in Geologic Structures and Materials, October 5-7, 1981

The Fracturing Activity prior to Coal or Rock Outburst in Cross-Measure Drivages

Yoshiteru WATANABE, Iwao NAKAJIMA and Kenichi ITAKURA
Mining Machinery, Department of Mineral Resources Development Engineering

In this research, the acoustic emission activity generated prior to coal or rock outbursts was observed in the drivages at intersection with the outburst-prone seams of coal and sandstone.

In practice, acoustic emissions associated with rock fractures occurring ahead of working faces were detected with a high probability in the process of the stress redistribution after blasting.

Especially, the acoustic emission activity after blasting becomes remarkable at a high level prior to the outbursts when the working face approached geologically weak bands with mylonite or sandstone seams saturated with gas. Consequently, it was confirmed that the impending outbursts could be predicted with considerable accuracy by monitoring the degree of acoustic emission activity after blasting.

XIX International Conference of Research Institutes on Safety in Mines, October 6-14, 1981

The Applications of AE Techniques as a Forecasting Method to the Rock and Gas Outburst in Coal Mine

Yoshiteru WATANABE, Iwao NAKAJIMA
Mining Machinery, Department of Mineral Resources Development Engineering
Tetsu FUKAI
The Coal Mining Research Centre
and Toyohiko HIROTA
National Research Institute for Pollution and Resources
Hokkaido Mining Research Center

To date the rock and gas outbursts in coal mines have been considered to occur instantaneously after blasting without any warning signs. However, according to the observational results obtained in this research, the AE activity accompanying the outburst triggers the action from the previous blasting. As a result of the consideration on the mechanism of the outburst occurrence, the forecasting appears to be possible if the degree of the cumulation of cracks in the rock ahead of the face is estimated by monitoring the AE activity in addition to the measurements of gas content. Especially regarding AE activity, sufficient information to identify the outburst-prone seams could be obtained from the observational results only for a few minutes after blasting.

International Symposium on Powder Technology '81, Sept. 27 - Oct. 1, 1981, Kyoto, Japan

Agglomeration in Liquid
— Review of Research in Japan —

Takakatsu TAKAMORI
Faculty of Engineering,
Hokkaido University.

Research and applications of agglomeration-in-liquid in Japan are classified into two categories according to the difference in mechanism of generating cohesive force. One is the method using polymeric flocculants, and the other is the use of an immiscible second liquid; the former is called "pelleting flocculation" and the latter is called "agglomeration-in-liquid". The present paper refers to the following subjects: the effects of various factors on the formation and growth of agglomerates, and the relation between formation and growth of agglomerates and liquid-liquid-particles system, together with simulation of agglomeration-in-liquid, research on application of agglomeration-in-liquid, and pelleting flocculation process.

International Symposium on Powder
Technology '81, Sept. 27 - Oct. 1, 1981,
Kyoto, Japan

Fundamental Studies on Agglomeration of Coal in Water

Takakatsu TAKAMORI, Tsuyoshi HIRAJIMA,
Masami TSUNEKAWA and Akira OTSUKA
Faculty of Engineering, Hokkaido University.

The Effects of the following factors on the agglomeration of coal in water were studied experimentally : impeller speed, pulp density, clayish slime content, pH, kind of bridging liquid and its added amount. Each factor produced significant effects on the agglomeration behavior. In addition, the influence of the degree of coalification on the agglomeration characteristics were studied, using four kinds of coal ranging from coking coal to brown coal. And it was confirmed that the most suitable kind of bridging liquid for coal must be selected for its effective agglomeration.

The Aus. I.M.M. Illawarra Branch
Symposium, "Seam Gas Drainage with
particular reference to the Working
Seam", May 1982

CONSIDERATIONS TO INCREASE GAS DRAINAGE RATIO Based UPON METHANE DRAINAGE PRACTICE IN JAPAN

K. HIGUCHI, K. OHGA and T. ISOBE

Based upon numerous and long practical experiences with gas drainage from coal seam and the results of investigations on the gas flow through in si-tu coal seam using tracer gases, it became clear that solid coal itself is hardly gas permeable or has extremely low gas permeability. Almost all of gas flows from a coal seam into boreholes through fracture networks intersecting with them.

Primary and secondary fractures in coal seams differ in their size and continuity from place to place according to differences of the coal strength and the stress conditions. A considerable amount of gas can be drained through boreholes which intersect with many and/or wide fractures.

A mathematical model for gas flow from a coal seam to a borehole through a discoidal fracture is proposed. From numerical analyses, the apparent radius of the discoidal fracture in this model is shown to be a good indication of the gas drainage ratio.

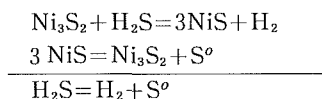
In addition to this, an attempt to make fractures around a borehole using high velocity water jet (ca. 1mm dia., 300-700atm., 100-200 l/min.) is introduced.

4th World Hydrogen Energy Conference,
Pasadena, USA, 13-18 June 1982.

Thermochemical Decomposition of H₂S with Nickel Sulfide

H. KIUCHI, K. FUNAKI, Y. NAKAI and T. TANAKA
Department of Metallurgical Engineering, Hokkaido University

The two-step thermochemical decomposition cycle of H₂S was proposed as described below and the experimental studies were made on the cycle.



The use of lower sulfide such as Ni₃S₂ was regarded as rather important based on thermodynamic and kinetic investigations.

Ni₃S₂ powder was mixed with Al₂O₃ to avoid the sintering associated with the depression of melting point caused by desulfurization of NiS. In the fundamental experiments, the effects of reaction factors were investigated. The cycle under optimum conditions was scaled up by 10 times and the thermal efficiency was estimated to be 51-54%.

8-th International Congress on Metallic
Corrosion, Mainz, Fed. Rep. Germany, 6-
11 Sept. 1981

Continuous Measurement of Corrosion Rate and Corrosion Loss in Molten Salt Systems

Tatsuo ISHIKAWA and Takeshi SASAKI
Department of Metallurgical Engineering, Faculty of
Engineering, Hokkaido University, Sapporo 060 Japan

In order to elucidate the corrosion behavior and the amount of corrosion in various molten salts, the usual immersion tests were carried out and also electrical resistance of wire specimens were followed with time in ammonium bisulfate melts of 170° to 230°C and in alkali nitrate melts of 350° to 450°C.

According to time variation of measuring resistance, the amount of corrosion and corresponding rate constants can be calculated from the diameter, length, specific resistance and density of the specimens without the results of immersion tests. The corrosion behaviors clarified are as follows: 1) Linear law for iron in bisulfate melts, 2) Logarithmic law for stainless steel in the same melts, 3) Parabolic law for iron in nitrate melts.

Although limited by the shape and size of the specimen, such sensitive resistometry would be a useful technique for the continuous determination of corrosion behavior in various salt systems.

International Pacific Conference on
Automotive Engineering, SAE, Hono-
lulu, Hawaii, November 16-19, 1981

Smokeless, Low NO_x, and Low Noise Diesel Combustion with Methanol as the Main Fuel

Takemi CHIKAHISA, Noboru MIYAMOTO, and Tadashi MURAYAMA
Department of Mechanical Engineering
Hokkaido University

In order to obtain an improved combustion of methanol in a dual fuel diesel engine, both main and auxiliary fuels were injected into a pre-combustion chamber; namely, a small amount of diesel oil was injected into the pre-combustion chamber as an ignition source prior to the introduction of a large amount of methanol.

Among various timings of the auxiliary injection, including VIGOM injection, pilot injection was the best for combustion of methanol as the main fuel.

As a result, with methanol as high as 95% of the total energy input, combustion took place without misfiring or knocking. Moreover, the combustion was smoother, smokeless, with a lower NO_x, and lower noise than for diesel oil, while the specific heat consumption was maintained at the same level as in the conventional operation with diesel oil. Additionally, concentrations of hydrocarbons and unburned methanol in the exhaust gas were very low in the same order as in conventional diesel operation.

Fifth International Symposium on Alco-
hol Fuel Technology, Auckland, New
Zealand, May 13-18, 1982

Ethanol Introduction into the Intake Manifold in a Diesel Engine up to 80% of Total Energy Supply without Knocking

T. MURAYAMA, N. MIYAMOTO and T. CHIKAHISA
Department of Mechanical Engineering
Hokkaido University

This work was carried out to study the prevention of knocking and misfiring in a diesel engine operated with ethanol as the main fuel injected into the intake manifold.

It was found that knocking in carbureted alcohol diesel engines can be classified into two types; one is a diesel knock with a very large premixed heat release and the other is auto-ignition in the end gas. Unexpectedly, a reduction in compression ratio reduced the knocking to only a limited extent. It was necessary to reduce the volumetric ratio of the pre-chamber to clearance volume as well as to reduce the compression ratio moderately in order to prevent knocking.

By reducing pre-chamber to clearance volume ratio, the amount of ethanol that can be introduced without knocking can be increased from 40% to 80%.

Fifth International Symposium on Alcohol Fuel Technology, Auckland, New Zealand, May 13-18, 1982

Glow Plugs or Spark Plugs Make the Efficient Use of Neat Alcohol Fuels Possible in a Diesel Engine

Noboru MIYAMOTO, Kenji YAMAZAKI and Tadashi MURAYAMA
Department of Mechanical Engineering
Hokkaido University

This paper deals with the development of efficient use of neat alcohol fuels in diesel engines with a forced ignition aid to promote the stable combustion of the alcohol fuels. The forced ignition aid, either a glow plug or a spark plug was used, was attached in a simplified two dimensional swirl chamber, and the effects on the combustion of neat alcohol fuels were examined.

As a result, the effects of engine operating conditions and combustion chamber configuration, including the position of ignition aids, were clarified for the ignition or combustion behavior of the neat alcohol fuels, compared with the engine performance of usual diesel oil.

It was established that with the aid of glow plugs or spark plugs, stable operation as well as soot free and low NO_x combustion was possible with neat alcohol fuels in diesel engines.

Fifth International Alcohol Fuel Technology Symposium, May 13-18, 1982
Auckland, New Zealand

Methylnitrite Formation in Exhaust Gases Emitted from a Methanol Fueled S. I. Engine

Kenichi ITO and Toshiaki YANO
Department of Mechanical Engineering Hokkaido
University, Sapporo, Japan
Takashi OKUBO
Disel Kiki CO., Ltd., Tokyo, Japan

Methylnitrite is one of new pollutants encountered at methanol fueling. The paper describes the relation between methylnitrite formation and engine operating conditions. A part of exhaust gas was sampled at a distance of 30 mm from the exhaust valve and introduced into a quartz reactor with a volume of 91 ml. The temperature of the reactor was thermostatically controlled between 295 and 473 K.

Methylnitrite concentration increased with the increase of reaction time. An increase in reactor temperature resulted in a decrease in the formation rate of methylnitrite. Methylnitrite emission characteristics were similar to that of nitrogen dioxide formed from nitric oxide in the sampled gases.

From these results, it may be concluded that most of unburned methanol might be converted to methylnitrite in the presence of nitrogen oxide in the atmosphere. The conversion reaction did not occur in the exhaust tubing because of high gas temperature and short residence time.

The 17th IUFRO World Congress,
Kyoto, Japan September 6-12, 1981

STUDIES OF THE VIBRATION AND THE TRANSMISSIVE FORCE OF CHAIN SAWS

Tadahiko KANAUCHI

Department of Mechanical Engineering

In forestry, the chain saw has become widely used. However, due to vibration and transmissive forces, operators of chain saws at times experience physical disabilities in hands and arms.

This paper describes experiments, which have not been reported on the acceleration and transmissive forces to the arm, and gripping force of the handles, under various cutting conditions. A higher acceleration follows after higher cutting velocity, but tighter gripping of the handle reduces the acceleration due to the vibration, while at the same time the transmissive force to the arms increases.

At low velocities, high values of the transmissive force are measured in the vertical direction, due to the unstable rotating force of the engine. The Cutting force increases the acceleration at relatively low velocities, and decreases it at high velocities. A linear relation between the transmissive force and the feed per one cutting tooth of the saw exists. The effect of the anti-vibration handles depends on the cutting conditions, on the other hand the value of the vibration acceleration can be reduced to 1/3-2/3.

CIB S17 Heating and Climatization;
Symposium on the Efficiency of Heating,
September 23-25 1981, Delft, Netherlands

Performance of the kerosene Oil-fired Stoves as an individual Heating Unit

Takashi SONODA, Hiroshi TANIGUCHI, Tatsuo TANAKA and Hiroshi HAYASAKA
Dept. of Mechanical Engineering, Hokkaido University

As an individual heater for space heating of residences and offices, various types of kerosene oil-fired stoves have been used in northern districts of Japan, and also they are recently exported to other countries. But regarding their heating performances from both an energy conservation and emission pollutant point of view there have been few studies.

This paper describes the results of experiments and analysis showing the heating effect and the combustion performance for several types of stoves. The combustion experiments were conducted according to JIS and that the emission products, such as NO_x, are measured.

It is found that the maximum thermal efficiency attains more than 80%, although it is much dependent on the supplied air amount for combustion, and the maximum NO_x concentration in the exhaust gas shows about 80 ppm. By the computer simulation the gas flow pattern in the combustion chamber of the stove is obtained.

American Foundrymen's Society 86th
Casting Congress, April 19-23, 1982
McCormick Place, Chicago, USA

Strength Evaluation of Cast Iron Circular Plate by the Finite Element Method

Toru NOGUCHI and Kingo NAGAOKA

Department of Mechanical Engineering II, Faculty of Engineering

The fracture strength of a cast iron circular plate was investigated with stress analysis by the finite element method considering the nonelastic stress strain behavior of the material.

From the experiments the nominal bending strength of cast iron beams and plates computed by elastic formula are 2-3 times the tensile strength. According to the stress analysis, this was attributed to the stress relaxation by the non-elasticity, and over stressed region where the working stress exceeds the tensile strength of the material.

A new criterion with a constant over stressed depth δ was introduced for the fracture of cast iron under stress gradient, where δ is 2-4 mm and depends slightly on temperature and stress gradient.

Metallurgically, δ was related to the size of a graphite eutectic cell. By the concept of δ , high bending strength, low notch sensitivity and their dependence on temperature are explained.

It was also useful to estimate the effect of ribs in bending plates.

11th International Symposium on Industrial Robots 7. 8. and 9. Oct. 1981 Tokyo
Japan

PATTERN RECOGNITION PROBLEM ON MODELED 3-D GEOMETRY

Y. KAKAZU, N. OKINO and K. UTSUMI

Institute of Precision Engineering, Faculty of Engineering,
Hokkaido University, North-13, West-8, Sapporo, 060 Japan

In CAD/CAM fields, how to model/describe a 3-D solid object/geometry/shape has been recognized as one of the most important problems for realizing an ideal CAD/CAM. The reason is that the geometric information is regarded as only one candidate for common data from the upper stream of CAD/CAM to the lower streams, eg. Assembly, Robotics areas etc.. In this sense, realization of a 3-D Geometric modeler, a sensor for Modeled 3-D geometry and an identifier for Modeled 3-D geometry are developed. Namely, each of them is "Formulated Pattern", "Soft Sensor" and "Auto-ID", and they have the abilities of being available for usage for higher intelligence industrial robots.

CAD 82 Proceedings of the 5th International Conference on Computers in Design Engineering, 30 March-1 April 1982, Brighton, UK.

**CAMPS-Computer-aided manufacturing for punching-press
and shearing**

M. FURUKAWA*, Y. KAKAZU** and N. OKINO**

*Asahikawa Technical College, Japan

**Hokkaido University, Japan

This paper describes the software system CAMPS for CAM in sheet metal production. CAMPS handles product layout on raw sheet metal, determination of NC punching-press tool paths, and determination of NC shearing tool paths.

To do this, a simple input language, and four mathematical models and their solutions suitable for implementation on a minicomputer are developed.

As a result, it becomes possible to construct an integrated punching-press and shearing CAM system for sheet metal production.

CAD 82 Proceedings of the 5th International Conference on Computers in Design Engineering, 30 March-1 April 1982, Brighton, UK.

RESEARCH ON 3-D GEOMETRIC MODELING BY SWEEP PRIMITIVES

Y. SHIROMA, N. OKINO and Y. KAKAZU

Dept. of Precision Eng., Faculty of

Engineering, Hokkaido University, Sapporo Japan

This paper proposes a new modeling method for not only ordinary mechanical part geometry but also for special configurations forms such as a coil or a bend etc.. The new method is called "Sweep Primitives", because of constructing volumetric primitives by sweep operation and combining these primitives by set operations. The mode of development of a sweep primitive is as follows, namely, called referred to as "secondary pattern" as the spine of sweeping/trajectory curve and "primary pattern" as the swept pattern along the secondary pattern. And these primary and secondary patterns are represented by "language" then we can use these with other volumetric primitives. As a result of developing and adapting this sweep primitive method, most of the mechanical part geometries are easily modeled with less effort.

International Conference on Point Defects and Defect Interaction in Metals, Kyoto 1981

Formation of Point Defect Clusters in Electron Irradiated Dilute FCC Alloys

Tadashi EZAWA, Yasuhiro KAWAMATA, Masayoshi SUEHIRO and Michio KIRITANI*

Department of Material Physics, Faculty of Engineering Science,
Osaka University, Toyonaka, Osaka 560, Japan

*Department of Precision Engineering, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

In situ electron irradiation experiments in a high voltage electron microscope were carried out to study the influence of about 500 at. ppm of solutes on the formation of interstitial type dislocation loops. The addition of Sn, Sb and Ge to Au increases the number density and decreases its temperature dependence. The addition of Cu, Ag, Si, Zn and Mg to Al suppresses the formation of loops to each different degrees. All of the observed results are clearly understood from the strength of interaction of interstitial atoms with solutes which is definitely in the series of the volume size factor of solute atoms in the solvent. A possibility of the fast migration of strongly bound vacancy-solute pairs in gold-based alloys is inferred from the observed smaller temperature dependence of the growth speed of the loops.

International Conference on Point Defects and Defect Interactions in Metals, Kyoto 1981

Localized Formation of Stacking Fault Tetrahedra by Electron Irradiation in FCC Metals

Masayoshi SUEHIRO, Naoaki YOSHIDA* and Michio KIRITANI**

Department of Material Physics, Faculty of Engineering Science,
Osaka University, Toyonaka, Osaka 560, Japan

*Research Institute for Applied Mechanics, Kyushu University,
Higashiku, Fukuoka 812, Japan

**Department of Precision Engineering, Faculty of Engineering,
Hokkaido University, Sapporo 060 Japan

The distributions of stacking fault tetrahedra formed in copper, nickel and gold by electron irradiation in a high voltage electron microscope have been observed with stereo-electron-microscopy. Their distributions have localized regions near the electron incident surface and/or near the bottom surface. These distributions are attributed to the two distinct damage processes which directly bring about the local enrichment of vacancies. One is the replacement sequence collision damage and the other is the sputtering of atoms. Both processes are found to change remarkably with a slight change in the electron diffraction condition, and the oscillation of the current density of electrons at the atom row is proved to exist along the depth distance through the crystal.

International Conference on Point Defects and Defect Interactions in Metals, Kyoto 1981

Mössbauer Study on Fe-Vacancy Interaction in Aluminum

Saburo NASU and Michio KIRITANI*

Department of Material Physics, Faculty of Engineering Science,
Osaka University, Toyonaka, Osaka 560, Japan

*Department of Precision Engineering, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

^{57}Fe Mössbauer spectroscopy was used to discuss the Fe-vacancy interaction in aluminum. Satellite lines have been observed in low-temperature deformation experiment and suggested that the satellites are due to the multiple complex reactions between Fe and vacancies.

On the other hand, the satellite observed in quench-experiment suggested that the binding energy between Fe and vacancy is rather small.

The origin of the satellite seems to be different in both experiments, but isomer shift values are quite similar to each other.

International Conference on Point Defects and Defect Interactions in Metals, Kyoto 1981

Nature of Point Defects and Their Interactions Revealed by Electron-Microscope Observation of Their Clusters

Michio KIRITANI

Department of Precision Engineering, Faculty of Engineering
Hokkaido University, Sapporo 060, Japan

The type of defects formed by the aggregation of point defects is discussed. The interaction of interstitials with dislocations is viewed from the growth of dislocation loops. The annihilation process of defect clusters is also discussed. The primary damage process by high energy electrons is analyzed from the localized formation of vacancy clusters. Free migration of vacancies, especially in α -iron, is discussed from interstitial loop growth during high temperature electron irradiation, and the aging experiment of low temperature irradiation induced interstitial clusters indicates the vacancy motion at 220 K. Irradiation induced segregation of solute elements in dilute alloys is detected by impurity sensitive nucleation of point defect clusters.

International Conference on Point Defects and Defect Interactions in Metals, Kyoto 1981

Voids and Bubbles in Argon Irradiated Nickel

S. SASAKI, M. KIRITANI*, A. IWASE, T. IWATA and F. E. FUJITA**

Division of Physics, Japan Atomic Energy Research Institute,
Tokai-mura, Ibaraki, Japan

*Department of Precision Engineering, Faculty of Engineering,
Hokkaido University, Sapporo, Japan

**Department of Material Physics, Faculty of Engineering Science,
Osaka University, Toyonaka, Osaka, Japan

At the very beginning of energetic argon ion irradiation, interstitial type dislocation loops finish their nucleation, and then grow linearly with time. By continued irradiation, voids nucleate and grow without increasing their number density. Stereoscopic TEM observations of interstitial loops and voids show the distributions deeper and shallower than the ion stopping range respectively. Post-irradiation annealing experiment shows that each void contains gas atoms depending on the depth from the ion-incident surface. All the observed processes of formation and annihilation of different types of defect clusters by irradiation and annealing are explained by using the diffusion kinetics of point defects. The influence of gas atoms on the formation of these defects are discussed.

Fourth International Conference on Rapidly Quenched Metals, Sendai 1981

CRYSTALLIZATION AND RELAXATION IN AMORPHOUS Fe-B ALLOYS

Kazuki NUNOGAKI, Yoshiaki KATAO and Michio KIRITANI*

Department of Material Physics, Faculty of Engineering Science,
Osaka University, Toyonaka, Osaka 560, Japan

*Department of Precision Engineering, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

Growth behaviour of crystal grains of Fe₃B in amorphous Fe-B has been traced precisely during heating in an electron microscope. Observed non-linear growth of the crystals and variation of the growth speed with temperature lead to the conclusion that the born atoms first embedded in primarily crystallized fine-crystal particles diffuse out to the amorphous phase during the growth of large Fe₃B crystals, leading to the change of the crystallization speed.

Diffusion constant of boron in the amorphous phase is estimated to be $4 \times 10^{23} \text{cm}^2/\text{sec}$ with the activation energy of 4.8 eV.

Fourth International Conference on
Rapidly Quenched Metals, Sendai 1981

**LATENT VACANCY MECHANISM OF RELAXATION AND DIFFUSION
IN AMORPHOUS METALS**

Michio KIRITANI and Tadashi HAMADA*

Department of Precision Engineering, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

*Osaka Prefectural Industrial Research Institute
Nishiku, Osaka 550, Japan

Inhomogeneity in atomic scale is expressed by the distribution of expanded and compressed volumes, which can be called as latent vacancies in amorphous materials, and the distribution of the pressure in atomic scale is calculated by the aid of molecular dynamics. The motion of an atom from compressed to expanded volume is demonstrated to be an elementary process of relaxation and diffusion. Strong temperature dependent variation of the activation energy spectrum of atomic motion is derived as a characteristic of the diffusion in amorphous solids.

The 6th International Conference on
Textures of Materials, Sept. 28-Oct. 3,
1981, Tokyo, Japan

**On the Recrystallization of Cu-Al Alloy
- The Effects of Two-step Annealing on the
Recrystallization Texture Development -**

Akira OKADA and Hitoshi NAKAÉ
Department of Precision Engineering

The TTT-diagrams for the recovery and recrystallization of heavily cold-rolled Cu-Al alloys with 10 and 15 at % Al were depicted from X-ray data. On the basis of the TTT-diagrams, two-step annealing procedures were adopted for investigating the effect of recovery and short-range ordering on the recrystallization-texture development.

Application of preliminary annealing below 583K prior to the recrystallization annealing enhanced the development of the major recrystallization texture component and decreased the minor component. The effect of the preliminary annealing became stronger with the decrease in temperature and this appeared to be most remarkable at 503K. At this temperature, a short time annealing suppressed the development of the major component, whereas the prolonged annealing enhanced it. This may be discussed from the viewpoint of the competition of the recrystallization with the short-range ordering and recovery in the recrystallization front region.

International Federation of Automatic
control 8th Triennial World Congress
Kyoto, 24-28 August 1981

ON THE COMPENSATION IN LINEAR FEEDBACK CONTROL SYSTEMS
(Transfer Function Attainable by Realizable Linear Compensation)

Ryozaburo TAGAWA

In a linear feedback control system, the following two kinds of transfer functions, i. e.

(1) the transfer function between the reference input and the controlled variable,

(2) the transfer function between the disturbance and the controlled variable,

are important.

The present paper provides replies to the following questions, i. e.

(a) what are these transfer functions (1) and (2) respectively which are independently attainable by realizable linear compensation ?

(b) what are the pairs of these transfer functions (1) and (2) which are simultaneously attainable by realizable linear compensation ?

under the condition that the given controlled objects have a single input, single output, single disturbance and directly measurable additional variables.

International Federation of Automatic
control Symposium on Theory and
Application of Digital Control, New
Delhi, 5-7 January 1982

**CAD Covering All Pulse Transfer Functions Attainable
by Linear Compensation**

Ryozaburo TAGAWA and Seiya YOGO

In the design of a linear discrete time feedback control system, the following two kinds of pulse transfer functions, i. e. (1) the pulse transfer function between the reference input and the controlled variable and (2) the pulse transfer function between the disturbance and the controlled variable, are important because they directly reflect the basic properties of the control system.

When a controlled object is given, however, the pulse transfer functions (1) and (2) which are attainable by realizable linear compensation are usually limited to the respective particular ranges which depend on the properties of the given controlled objects.

Recently, we have been successful in clarifying these particular ranges, and we have been also successful in deriving a structure of compensator by the use of which all pairs of the pulse transfer functions (1) and (2) within these particular ranges are realized simultaneously.

The present paper gives a new CAD system of linear discrete time feedback control system which is based on these theoretical backgrounds.

Optical Microlithography, Technology
for the Mid 1980s March 1982, Santa
Clara, California U.S.A

Checking of the thickness uniformity of thin film layers in semiconductor devices by laser ellipso-interferometry

Teruhito MISHIMA¹⁾ and Kwan C. KAO¹⁾

- I) Department of Electronic Engineering, Faculty of
Engineering, Hokkaido University, Sapporo 060 JAPAN
II) Department of Electrical Engineering, University of
Manitoba, Winnipeg, Manitoba, CANADA

New laser ellipso-interferometry has been developed for the determination of two dimensional thickness distribution of a thin film. This technique differs from the conventional ellipsometry and interferometry in that the new laser ellipso-interferometer can be used without the scanning technique to map the thickness distribution of a whole thin film, and that its spatial resolution is high and can reach the diffraction-limited resolution under certain conditions. In this paper the principle and the applications of this technique are described and some experimental results are presented to demonstrate the use of this technique for checking the thickness uniformity of an oxide layer in semiconductor devices. This new technique is nondestructive and the time required for this kind of measurement is much less than that by any other conventional techniques.

Fourth International Conference on
Rapidly Quenched Metals, August, 24-28,
1981 Sendai, Japan

The Crystallization of Amorphous Pd₈₀Si₂₀ Alloys

Masao MAEDA and Masafumi TANIWAKI
Department of Electronic Engineering, Faculty of Engineering,
Hokkaido University, Sapporo, Japan

Several workers have reported the effect of the atmosphere on the crystallization process of Pd₈₀Si₂₀ amorphous alloy. The present authors investigated the crystallization process of Pd₈₀Si₂₀ in atmospheres at higher temperature than 250°C using AES and ESCA experiments, Amorphous Pd₈₀Si₂₀ alloys prepared by the twin roller method were annealed in vacuum of 10⁻⁵ Torr, in 99.99% pure Ar gas flow and in silicon oil. AES experiments were made on the alloys which were being sputtered at a constant etching rate.

The Si depleted zone and/or Si deficient zone are formed on the surface region during aging in Ar or silicon oil. Fcc Pd appears and grows rapidly in these zones. In vacuum the growth of the zones is not so remarkable and fcc Pd and Pd₃Si are formed slowly.

Fourth International Conference on
Rapidly Quenched Metals, August, 24-28,
1981, Sendai, Japan

Mössbauer Analysis on the Crystalliation Process of Amorphous $\text{Fe}_{75}\text{Si}_{15}\text{B}_{10}$ Alloys

Masafumi TANIWAKI*, Masao MAEDA*, Shinji UMEYAMA** and Yoichi ISHIDA**

*Department of Electronic Engineering, Faculty of Engineering
Hokkaido University, Sapporo, Japan

**Institute of Industrial Science, University of Tokyo, Roppongi 7-22-1,
Minato-ku, Tokyo 106, Japan

The crystallization of amorphous $\text{Fe}_{75}\text{Si}_{15}\text{B}_{10}$ was investigated by Mössbauer analysis (transmission method and back scattering method), X ray, AES, DSC and the thermal expansion measurement. Especially this study was designed so as to detect the difference between the crystallizations in three regions; the interior of the alloy, the roll side and the free side.

The crystallization processes of these regions differed from one another. The roll side crystallized most rapidly and the interior crystallized most slowly. Before annealing, the surface conditions of the roll side were different from those of the free side. On the roll side Si atoms were oxidized heavily and Fe and B concentrations were found distributed. This seemed to cause the difference of crystallization rate in the alloy.

Yamada Conference V on Point Defects
and Defect Interactions in Metals
November 16-20, 1981, Kyoto, Japan

Mössbauer Analysis on the Annealing Process of a Quenched Al-Sn Dilute Alloy

Masafumi TANIWAKI*, Shinji UMEYAMA** and Yoichi ISHIDA**

*Department of Electronic Engineering, Faculty of Engineering,
Hokkaido University, Sapporo, Japan

**Institute of Industrial Science, University of Tokyo,
Roppongi 7-22-1, Minato-ku, Tokyo, Japan

The interactions between Sn and vacancies during the annealing process of a quenched Al-45ppm Sn alloy are studied directly by Mossbauer effect.

In the quenched specimen Sn-vacancy pair, vacancy aggregates and Sn-vacancy aggregates are formed. At 213K-253K, free vacancies migrate so that vacancy aggregates and Sn-vacancy aggregates increase and grow. At 273K-313K vacancy aggregates dissociate and Sn-vacancy aggregates increase and grow. At 333K the nuclei for β -tin seem to form.

The binding energy between an Sn atom and a vacancy is 0.10-0.15eV. The values obtained in the past were overestimated.

Sn-vacancy aggregates are stable and they play an important role in the retardation of the recovery of Al alloys.

Yamada Conference V on Point Defects
and Defect Interactions in Metals
November 16-20, 1981, Kyoto, Japan

Recovery in Electron Irradiated Aluminium Observed by Mössbauer Spectroscopy

S. UMEYAMA*, K. SASSA*, M. TANIWAKI**, Y. Ishida* and H. YOSHIDA***

*Institute of Industrial Science, University of Tokyo,
7 Roppongi, Minato-ku, Tokyo, Japan

**Department of Electronic Engineering, Faculty of Engineering,
Hokkaido University, Sapporo, Hokkaido, Japan

***Research Reactor Institute, Kyoto University,
Kumatori, Sennan-gun, Osaka, Japan

The recovery of vacancies and the interaction between vacancies and Co impurity in Aluminium are investigated using Mossbauer spectrum of ^{57}Co .

The spectrum of prequenched and electron irradiated Aluminium consists of four components; S-, V-, I-lines and X line. S-, V-, I-lines correspond to solid solution ^{57}Co , ^{57}Co trapping vacancies and ^{57}Co trapping interstitial atoms respectively. X-line does not appear in Aluminium without prequenching and irradiation. The line corresponds to smaller Co-vacancy aggregates. The growth of Co-vacancy aggregates occurs at 175K, showing that the vacancies migrate at the temperature. Above the stage, no interactions are detected between vacancies and Co atoms. The interaction between Co impurity and single vacancy appears to be weak.

Japan-USA Seminar, "Chemistry of Coal
Liquefaction", Salt Lake City, Utah,
Jan., 1982

Catalytic Liquefaction of Coal by a Mixture of Carbon Monoxide and water without Vehicles

Y. TAKEMURA* and K. OUCHI**

*Faculty of Education, Akita University, Akita, 010, Japan

**Faculty of Engineering, Hokkaido University, Sapporo, 060, Japan

Various coals were hydrogenated at 350-450°C under CO and H₂O system using Co-Mo catalysts for 1 hour. After the reaction, the products were extracted with pyridine. Conversion decreased from 70% to 20% with coal rank, which means that the lower rank of coals are suitable for this reaction. Conversion also increased with CO pressure and reaction time. Catalyst type was examined. MoO₃ was found to be most active.

Japan-USA Seminar, "Chemistry of Coal Liquefaction", Salt Lake City, Utah, Jan., 1982

Hydrogenation in Molten NaOH

K. OUCHI, S. HOSOKAWA, K. MAEDA and H. ITOH
Faculty of Engineering, Hokkaido University, Sapporo, 060, Japan

Taiheiyo and Shin Yubari coals were reacted at 350-500 °C for 15 and 60 minutes under 10 and 13 MPa nitrogen or hydrogen initial pressure. The solid yield decreased from 80% to 30% for Taiheiyo coal and from 90% to 60% for Shin Yubari coal under both atmospheres. Gased and absorbed CO₂ amounted 15 to 50% for Taiheiyo coal and 10 to 40% for Shin Yubari coal. Nearly all solid product of Taiheiyo coal at 400°C can be dissolved in pyridine in both atmospheres. Benzene extract in hydrogen atmosphere was 90%, but that in nitrogen was only 20% at 500°C. For Shin Yubari coal pyridine extract in hydrogen was 90% at maximum, but in nitrogen it was only 40%. Benzene extract in hydrogen was 60%, but in nitrogen it was only 10%.

Japan-USA Seminar, "Chemistry of Coal Liquefaction", Salt Lake City, Utah, Jan. 1982

Liquefaction without using hydrogen

K. OUCHI, F. MONDRAGON, M. MAKABE and H. ITOH
Faculty of Engineering, Hokkaido University, Sapporo, 060, Japan

Hydrogen produced from the decomposition of methanol using catalyst ZnO-Cr₂O₃ was utilized for the hydrogenation of coal in the presence of hydrogenation catalysts at 400°C for 1-2 hours. Ni, Co and Ni-Cr-Cu catalysts gave excellent results. n-Hexane soluble yield was 65% and the softening point of pyridine extract was about 100°C. H/C ratio increased from 0.97 to 1.15 and the molecular weight was 621.

Symposium on Characteristics of Australian Coals and their Consequences for Utilization, Sydney, Australia, May 1982

Liquefaction of Coals Using Nascent Hydrogen

K. OUCHI and F. MONDRAGON
Faculty of Engineering, Hokkaido University, Sapporo, 060, Japan

The following four types of reactions were discussed.

1) Alkali-alcohol-coal system.

For example ethanol reacts with NaOH producing Na-acetate and hydrogen. This hydrogen can hydrogenate coal. Even at 300°C nearly all the reaction products could be dissolved in pyridine.

This reaction is especially effective for the lower rank of coals. Temperature, pressure, time, ratio of alcohol to alkali, species of alkali and alcohol were examined.

2) Alcohol itself can liquefy coal at rather higher temperature range than 400°C. Alcohol can easily give hydrogen to coal and alkylation also contributes to the high solubility of the product. The reaction conditions were examined.

3) Decomposition of methanol and utilization of hydrogenation catalyst can also hydrogenate coals. Ni, Co, Ni-Cr-Cu catalysts were quite effective. The reaction conditions were examined.

4) Hydrogen produced from the reaction of zinc and water at 430°C can also hydrogenate coal effectively using a suitable solvent.

7th International Biophysics Congress,
Mexico City, Mexico, Aug. 23-29, 1981

Cellulose Component of *Acetobacter xylinum* Pellicle; Morphology and Its Significance for the Mechanism of Microfibril Formation

J. ROSS COLVIN, Mitsuo TAKAI, L. C. SOWDEN and J. HAYASHI

It is suggested that a primary, essential stage in the biological formation of a microfibril of Cellulose I is an extracellular, lateral association of presynthesized (1-4) - β -D -glucans, by hydrogen bonding, to form long, thin sheets.

These sheets then superimpose themselves, nonenzymatically, by London forces to form the nascent microfibril. The ends of the constituent glucans of the nascent microfibril may undergo extension or rearrangement.

The formation of the metastable, native structure (Cellulose I) may be deduced from the above suggestion as a natural consequence of the closest packing of the sheets. The irreversibility of the change from Cellulose I to Cellulose II, either by mercerization or regeneration, also follows from the postulate.

The suggestion also explains why cellulose microfibrils and chitin microfibrils may be formed continuously in cell walls without interference from each other.

High resolution, electron micrographs of the tips of newly formed microfibrils of bacterial cellulose which had been *very lightly*, negatively-stained with sodium phosphotungstate are consistent with the suggestion.

The Ninth Cellulose Conference, Syracuse, N. Y. USA, May 24-27, 1982.

Morphological Observation of Cellulose Microfibrils Degraded by exo- and endo-cellulases

Mitsuo TAKAI, Jisuke HAYASHI, Kazutosi NISUAWA and Takahisa KANDA

The action of endo-cellulase on bacterial cellulose produced 20 μ g/ml of reducing sugar (RS) after 90hr of hydrolysis. On the other hand, exo-cellulase rapidly dissolved about 40% of the cellulose by weight, which corresponded to a production of 540 μ g/ml of RS after 90hr. The DP of bacterial cellulose was reduced very quickly to 1300 from the original 2350 by the hydrolysis with

endo-cellulase, while that of the exo-treated cellulose was basically unchanged regardless of a large production of RS. It is shown that endo-cellulase attacks the inner glucosidic linkages of the cellulose molecule randomly to decrease DP. In contrast, exo-cellulase can readily attack at the nonreducing end of the molecule to split off cellobiose residues and to result in a large amount of RS. There is a large difference in the hydrolysis patterns of the cellulose by exo- and endo-cellulases.

The morphological action of endo-cellulase on the cellulose microfibrils was much more severe compared to that of exo-cellulase, in that highly pronounced transverse cracks and swelling of the microfibrils were visible at an early stage of the hydrolysis. In the SEM photographs of the exo-treated cellulose, no significant differences in the morphology of the microfibrils were detected compared to the control. It has been demonstrated that the modes of action of exo- and endo-cellulases on bacterial cellulose are quite different morphologically.

The Ninth Cellulose Conference, Syracuse, N. Y. USA, May 24-27, 1982.

Supermolecular Structure of Cellulose; Stepwise Decrease in LODP and Particle Size of Cellulose Hydrolyzed after Chemical Treatments

Jisuke HAYASHI, Mitsuo TAKAI, Yuichi SHIMIZU and Tadayoshi YACHI

All of the natural cellulose fibers showed the same LODP of about 200 after hydrolysis, in spite of the differences in their crystallinity and original DP. Cellulose II, III_I, III_{II}, IV_I, IV_{II}, cellulose triacetate and trinitrate were derived from natural cellulose fibers and rayons in fibrous state.

The cellulose modifications from natural cellulose fibers showed LODP of about 80 after hydrolysis, and all of those from rayon showed LODP of about 40.

The esters derived from ramie and cotton were saponified after heat treatment at 150°C into regenerated cellulose II. They also showed LODP of about 40. Cellulose III_{II} derived from mercerized ramie and cotton also showed LODP of about 40 after hydrolysis.

When the cellulose modifications derived from natural cellulose fibers were hydrolyzed and then ultrasonically treated, the LODP 80 and 40 particles were split into homogeneous fragments of 400A and 200A in length, respectively.

Through chemical and heat treatment in fibrous state, LODP of natural cellulose fibers decreased stepwise from 200 to 80 and 40, and their fragment size split by the hydrolysis decreased similarly from a long and varied one in the original cellulose to 400A to 200A. Crystallite sizes of natural cellulose fibers, rayons and their derivatives increased in width with an increasing degree of their crystallinity; however, the size remained constant in length at about 200A. These results suggested that both the natural cellulose fiber as well as consisted of a fundamental periodic structure of approximately 200A in length.

9th International Conference on Amorphous and Liquid Semiconductors, Grenoble, July 2-8, 1981

Silver-Doped Amorphous As_2Se_3 Films Studied by XPS

Tokihiro UENO and Akira ODAJIMA

Department of Applied Physics, Hokkaido University

In this report amorphous As_2Se_3 into which silver is diffused in an enhancing manner by photo-irradiation is studied by X-ray photoelectron spectroscopy (XPS). Photoelectron and Auger spectra were measured using a Vacuum Generators ESCA III spectrometer equipped with a Mg $K\alpha$ X-ray source (1253.6 eV).

Chemical shifts of the photoelectron and Auger lines for Ag indicate that electrons are liberated from Ag atoms upon photo-enhanced diffusion. On the other hand, the lowering in binding energy of the As and Se core electrons discloses that the electrons liberated from Ag are transferred into As and Se sites. These results suggest that Ag atoms migrate with As-Se bonds in the charged defect states upon photo-irradiation.

International Measurement Confederation (IMEKO) 9th World Congress, Berlin (West), Fed. Rep. of Germany, 24-28 May, 1982

Optical Probe for Narrow Sound Fields

R. OHBA

Department of Applied Physics, Faculty of Engineering
Hokkaido University

An optical probe microphone is proposed. It optically detects at a distance well removed, the movement of a sound receiving diaphragm located at the point using a graded-index optical fiber.

The sensitivity, frequency response and relations between the SNR performance and structure of the microphone system are investigated theoretically. It is confirmed that experimentally constructed microphones are as sensitive as the standard half inch condenser microphone and that the results of the theoretical investigation are valid. Applications of the microphone to probe for narrow sound fields are also presented.

12th Congress of the International
Commission for Optics, August 31-
September 5, 1981, Graz, AUSTRIA

Measurement of Transfer Function of Spectroscopic System

Hirofumi FUJIWARA and Tatsuhiko IKEDA

The transfer function (TF) of a spectroscopic system can be measured by using the sinusoidally modulated spectrum (SMS) which is obtained by introducing a light of a broad spectral width into the Michelson interferometer. The output spectral-density distribution (spectrogram) is given by the convolution of the input spectral-line spread function of a spectroscopic system as a function of frequency of light. The Fourier transform of the line-spread function is the TF of the system as a function of the delay time between the two beams through a interferometer. If the SMS is in the input plane, then the contrast and the phase of the spectrogram are equal to the modulation and phase transfer functions, respectively.

The MTF of a Czerny-Turner typed plane grating monochromator of high resolution was measured.

20th Symposium on Engineering Aspects
of Magnetohydrodynamics, UCL, Irvine,
California, June (1982)

A NEW LINE-REVERSAL METHOD USING THE LIGHT POLARIZATION TECHNIQUE

N. KAYUKAWA, Y. AOKI, Y. OZAWA, K. ODAGIRI and K. SATO*

Energy Conversion Research Institute

Faculty of Engineering, Hokkaido University

Kita Ku, Kita 13, Nishi 8, 060 Sapporo, Japan

* present address: Fuji Electric Corporate Research & Development Ltd., Matsumoto Shi, Nagano Ken.

A generalized line-reversal method employing the light polarization technique was proposed. Each of the reference lamp lights and the plasma emission was horizontally and vertically polarized and was detected through the same optical path without time delay. Thus, in principle, this method excluded the limitations on the temporal or spatial resolutions, which appear inherently in a conventional method employing a chopper or a knife wedge. The applicability of the present method to measure the MHD plasma temperature was confirmed experimentally in a shock tube MHD system.

Fourth ASTM-EURATOM symposium
on reactor dosimetry, March 22-26, 1982
at NBS Washington, DC

ENERGY DEPENDENT SENSITIVITIES FOR NEUTRONS OF SOLID STATE RECOIL TRACK DETECTORS

Masakuni NARITA, Fumiyuki FUJITA and Ken-ichi WADA,
Hokkaido University, Sapporo, 060 Japan
Katsuhisa KUDO and Taichi MICHIKAWA
Electrotechnical Laboratory, Ibarakiken, 305 Japan

Energy dependent absolute sensitivities for neutrons of solid state recoil track detectors (polycarbonate and cellulose nitrate foils) were measured with monochromatic neutrons (the energy range of 1.9 MeV to 5 MeV) from D (d, n) He reaction with an ETL Van de Graaff accelerator. After irradiation and chemical etching, an automatic track counting system, Luzex 450, counted the number of etched tracks.

The theoretical energy dependent sensitivities were calculated using the local energy loss theory by R. Katz and E. J. Kobetich and good agreement with the observed results was obtained.

8th International Congress on Metallic
Corrosion, Mainz, Fed. Rep. Germany, 6-
11, Sept. 1981

Passivity Breakdown and Pitting

Norio SATO
Electrochemistry Laboratory, Faculty of Engineering
Hokkaido University

A model of electrocapillary breakdown of passive films predicts that the film breakdown occurs above a critical electrode potential. It is also predicted from the film dissolution kinetics that above a certain potential the passive film is electrochemically unstable undergoing the potential-dependent transpassive dissolution.

The film breakdown does not necessarily lead to pitting. The stability of pitting is determined by the local ion build-up in the pit and there is a critical ion concentration (about $2 \text{ mol} \cdot \text{dm}^{-3}$ for stainless steel) above which stable pit growth occurs. This critical ion concentration appears to correspond for brightening pits to the lowest aggressive anion concentration required for the transition from etching dissolution to electrobrightening dissolution of metals and for etching pits to the lowest hydrogen ion concentration for depassivation. The local ion concentration at the metal surface is proportional to the product of the diffusion layer thickness δ and the metal dissolution rate i . Since δ is limited by convection ($\delta < 0.5 \text{ nm}$), the dissolution rate i less than a certain value ($i < 0.1 \text{ A} \cdot \text{cm}^{-2}$) does not cause stable pitting to develop on the flat metal surface, even if the local breakdown of the passive film occurs.

8th International Congress on Metallic
Corrosion, Mainz, Fed. Rep Germany, 6-
11 Sept. 1981

Titanium Enrichment in Anodic Oxide Films on Fe-3% Ti Alloy

Masahiro SEO and Norio SATO
Electrochemistry Laboratory, Faculty of Engineering
Hokkaido University

Enrichment of titanium in the surface oxide films during anodic oxidation of Fe-3% Ti alloy in pH 3.0 phosphate solution was investigated to examine the effect of alloying titanium on the corrosion resistance of iron. Three per cent-addition of titanium reduced the passivity-maintaining current density of iron to one-fifth. Titanium was enriched markedly in the anodic oxide films formed on Fe-3% Ti alloy. A significant amount of phosphor originated from the solution was distributed over the whole range of the film thickness. Both the amount of titanium enriched in the film and the film thickness increased, as the amount of electric charge required for passivation increased. The major part of the electric charge for passivation was the one that passed when the alloy was subjected to active dissolution before passivation. Atomic absorption analysis of the solution revealed that the preferential dissolution of iron as ferrous ions occurs in the active potential region. Passivated electrodes of Fe-3% Ti alloy and of pure iron, however, exhibited almost the same potential decay under open-circuit conditions in the solution.

From the results, discussions were made on the mechanism of film formation and on the role played by a titanium-enriched film in passivation.

22nd Corrosion Science Symposium,
Newcastle Upon Tyne, U.K. 15-18 Sept.
1981

Ellipsometric Study of Passive Films on Titanium in Phosphate Solutions

M. MASUDA, T. OHTSUKA and N.SATO
Electrochemistry Laboratory, Faculty of Engineering,
Hokkaido University

The passive films formed on titanium in phosphate solutions in a wide range of pH from acid to base were studied by ellipsometry. A multiple-angle-of-incidence ellipsometry allows the optical constant of the substrate titanium metal to be measured even in the presence of a thin surface film. The optical constant of titanium thus estimated is $n_M = 2.30 - 2.90i$ in fairly good agreement of the one estimated with a cathodically reduced titanium surface by use of a fixed-angle-of-incidence ellipsometry. For the passive film the optical constant was estimated to be $n_F = 2.10 - 0.03i$ which was scarcely affected by the electrolyte pH and the electrode potential as well. The thickness of the passive film at one-hour steady state was found to increase nearly linearly with the electrode potential giving for unit volt 2.8nm in phosphate solution and 2.0nm in sulphuric acid. It was also

found by Auger electron spectroscopy that phosphate and sulphate ions were incorporated in the outermost layer of the passive film.

Autumn Symposium, The Electrochemical Society Inc. Ontario-Quebec Section, Ottawa, Canada 30 October, 1981

Localized Corrosion of Metals

Norio SATO

Electrochemistry Laboratory, Faculty of Engineering

Hokkaido University

Metallic corrosion occurs in four different states, depending on the metal electrode potential, pH, and salt concentration in the environmental solution.

These are called the active, passive, transpassive, and brightening states. Localized corrosion results when more than one of them occur at different location on the same metal surface. Usually, the active or brightening dissolution takes place locally on the otherwise passive metal surface.

Localization of corrosion is the formation of a dissipative space structure and occurs when the fluctuation of corrosion exceeds a certain critical magnitude.

International Conference on II-VI Group Compound Semiconductors. Durham, U. K. 21-23, April 1982

Formation and Reduction of Anodic Oxides on HgTe and Cd_{0.2}Hg_{0.8}Te

H. H. STREHBLOW¹⁾, M. SAKASHITA¹⁾, B. LÖCHEL¹⁾

I) Institut für Physikalische Chemie, Universität
Düsseldorf, Düsseldorf, Germany

II) Faculty of Engineering, Hokkaido University

III) Institut für Physikalische Chemie, Freie Universität
Berlin, Berlin, Germany

Anodic oxides on HgTe and Cd_{0.2}Hg_{0.8}Te are of decisive importance for the performance of IR-detecting systems. The composition and the formation and reduction of these anodic oxides were studied with electrochemical methods including the rotating ring disc electrode and by X-ray photoelectron spectroscopy.

Protecting oxides are formed in weakly acidic and alkaline solutions. In strongly alkaline electrolytes the presence of 90% ethylene glycol is necessary to form a passivating oxide film. The presence of HgO is decisive for its stability. CdO stabilizes further for pH 13. These findings suggest that the oxide is composed of tellurites with different chemical properties such as a mixture of the simple oxides.

The content of HgO and CdO increases with pH. After reductive decomposition of the anodic oxide only a small Cd depletion is seen at the semiconductor/oxide interface for pH 13. A reductive pretreatment at $\varepsilon = -0.60V_H$ in acetate buffer pH 4.9 yields an oxide free surface with a composition equal to that of the bulk. These specimen served as a surface analytical reference for the XPS-analysis.

JPL/ACM-SIGNUM Conference on the
Computing Environment for
Mathematical Software, Pasadena, July
29-31, 1981

Algorithm Bank: Information System for Mathematical Software

Kaname AMANO, Masaki CHIBA, Akeno MOCHIDA
Hokkaido University Computing Center

and

Takashi MAEDA
Department of Engineering Science, Hokkaido University

A basic idea is presented for constructing an information system of mathematical softwares of fine quality, which is intended to support users in problem solving by computers.

Information on individual algorithms is represented by three types of attribute-value sets such as bibliographic attributes, functional attributes, and operational attributes. The values for these attributes are mostly the technical terms in computational mathematics or computer sciences. Using this representation scheme, problem-oriented retrieval becomes possible to some extent even with usual information retrieval methods.

However, for common users, more general information regarding a set of algorithms for a specific purpose which we call algorithmic knowledge should also be dealt with.

As the first step of the development of our system, a bibliographic information system of CALGO (Collected ALGOritms from acm) on ORION (Online Retriever of InformatiON) was constructed and reported.

Congress and 12th Assembly of the Inter-
national Commission for Optics, Graz,
Austria, August 31-September 5, 1981

Imaging by acoustically coherence-controllable illumination I. Double-slit imaging

Y. OHTSUKA and Y. IMAI

Department of Engineering Science, Faculty of Engineering,
Hokkaido University

Spatial coherence of laser light can be modified almost at will through the acousto-optic interaction. If a laser beam is modulated in phase over time and space by a progressive acoustic wave, its mutual intensity can be made to vary with a period of one acoustic wavelength. When a

double-slit separation is chosen as half of the acoustic wavelength, the double-slit image is increasingly resolved with the increase in the acoustic power, and its resolution improves over that achieved with incoherent illumination provided that the acoustic power exceeds a critical level. These effects are explained by the spatial frequency analysis of the image spectrum.

Congress and 12th Assembly of the International Commission for Optics, Graz, Austria, August 31-September 5, 1981

Imaging by acoustically coherence-controllable illumination II. Periodic object imaging

Y. IMAI and Y. OHTSUKA

Department of Engineering Science, Faculty of Engineering, Hokkaido University

Imaging characteristics of a cosinusoidal complex-amplitude object illuminated with acoustically phase-modulated laser light are investigated in association with periodicity, one of the most noticeable features of the acoustically modified mutual intensity of laser light. Because of this periodicity, the image contrast is much more enhanced with the increase in the acoustic power. This effect is explained by the fact that many higher-order components of the object spectrum are transmitted by a limiting pupil of the imaging system in the presence of the acoustic wave. Theoretical predictions are shown to be in good agreement with the experimental results.

Congress and 12th Assembly of the International Commission for Optics, Graz, Austria, August 31-September 5, 1981

Imaging by acoustically coherence-controllable illumination III. Extension to 2-D imaging

Y. OHTSUKA and Y. NOZOE

Department of Engineering Science, Faculty of Engineering, Hokkaido University

A proposal is made for acoustic 2-D modification of optical mutual intensity. The use of two independent acoustic waves, progressing at right angles, produces the acoustically modified mutual intensity that varies in 2-D periodic manner. Since 2-D periodicity of the modified mutual intensity is recognized to be negligibly small within a circular object concerned, the computer-generated image pattern is almost uniform in the azimuthal direction of the image plane. The acoustically phase-modulated light illuminating the object forms an image whose ringing effect is appreciably suppressed. The rising of the image near its edge is superior to that for the incoherent limit.

Morphology of Scales Formed on Some Fe-Mn Alloys under Low Sulfur Pressures at High Temperatures

Keizo NISHIDA and Toshio NARITA
Hokkaido University, Sapporo 060, Japan

Some Fe-Mn alloys containing about 12, 29 and 48 mass% Mn were sulfidized at sulfur pressures of 10^3 – 10^{-6} Pa and then examined by TGM, EPMA, SEM, and X-ray diffraction. With respect to the kinetics and scale morphologies, sulfidation behaviors could be divided into three pressure ranges, that is, region I $>P(S_2)=10^{-2}$ Pa, P $(S_2)=10^{-4}$ < region II $<P(S_2)=10^{-2}$ Pa, and region III $<P(S_2)=10^{-4}$ Pa for the 12% alloy at 1073K. A steep decrement of parabolic rate constants was observed in region II at each temperature for all alloys, and ascribed to the change in the scale structure from the duplex (Mn, Fe) S and (Fe, Mn) S layers to the single (Mn, Fe) S layer. The latter scale is accompanied with extensive internal sulfidation.

Chemical Structure of Coal Hydrogenation Liquids-Compound Type Estimation by TLC-FID-

S. YOKOYAMA, J. UMEMATSU, K. INOUE
T. KATOH and Y. SANADA

Characterization of coal liquids is important for the selection of optimum conditions for the coal liquefaction processes and for the assessment of the coal liquefaction products. In this study, compound types for coal liquid were investigated by thin layer chromatography-flame ionization detector (TLC-FID) by which quantitative analyses can be carried out routinely.

Individual peaks of TLC-FID for coal liquids were identified as paraffine, aromatics, polar compounds and asphaltenes in the order of the larger R_f values by comparison of compounds separated previously by conventional liquid chromatography (LC). The contents of the type of compounds for a series of samples obtained from the variation of the coal hydrogenation reaction time were obtained with a considerable good agreement between TLC-FID and LC procedure developed by USBM-API 60. By using the TLC-FID method, the distribution tendency of type compounds accompanied with the reaction conditions of coal hydrogenation could be derived quantitatively in a relatively easy manner.

International Conference on Coal
Science, Düsseldorf, September 7-9, 1981

Solubilization of Coal with Olefins and Cracked Light Oils from Petroleum

Y. SANADA, S. YOKOYAMA, M. SHIMOMURA,
S. ONO and H. MORITOMI

In this paper are reported the results from the treatment of coal with olefins under relatively mild conditions and the usefulness of olefins for coal solubilization. Coals were easily solubilized under atmospheric pressure at temperatures of 125-150°C in the presence of trifluoromethanesulfonic acid. The solubility of the treated coal depends upon the structure and constitution of the parent coal.

As the cracked oil contains olefins to a certain extent, thermal alkylation reaction of coal may occur simultaneously together with super critical extraction.

Without the catalyst, about 10-20% of the fed coal was extracted in light oil under the condition of 350°C and 50 atm within two hours.

Symposium on Characteristics of
Australian Coals and their Consequences
for Utilization, May 18-22, 1982, NSW,
Australia

Dehydrogenation Activities of Coal Liquefaction Catalysts

Y. SANADA and T. YOKONO

The amount of hydrogen evolved from the coal-catalyst system with the increasing temperature under atmospheric pressure was measured by gas chromatography. A close relationship was found between the amount of hydrogen evolved from coal-catalyst system under atmospheric pressure and that of benzene solubles from the same system with high pressure hydroliquefaction. For Akabira coal, the higher the amount of hydrogen evolution over the catalyst is, the better the conversion of coal into benzene solubles by high pressure hydroliquefaction becomes. Hydrogen evolution may be attributed to dehydrogenation of hydroaromatic groups, condensation of aromatic nuclei and dehydrogenation/condensation of methyl groups attached to aromatic rings from the experiments of model compounds.

Science of Coal Liquefaction Workshop,
May 24-28, 1982, Victoria, Australia

**Dehydrogenation Activities of Coal Liquefaction-
Catalysts on Various Ranks of Coals by Means of
Hydrogen Evolution**

T. YOKONO, S. SHIBATA, M. CHEE, H. HATTORI
K. TANABE and Y. SANADA

It has been recognized that hydrogen donor and acceptor mechanisms among coals and/or solvents play an important role in the fluid phase. It is, therefore, important to examine the behaviour of hydrogen in coal-catalyst systems during pyrolysis. The evolution of hydrogen varied with not only coal rank, but also with the type of catalysts. A correlation can be seen between the enhancement of hydrogen evolution with $\text{MoO}_3\text{-TiO}_2$ which has hydrogenation ability, and the atomic ratio of (H/C) of coal corrected by the amount of functional hydrogen attached to oxygen in coal.

The measurement of hydrogen evolution under atmospheric pressure is a rapid and convenient method of evaluating catalytic activities for coal liquefaction.

7th Ampère International Summer
School on New Techniques and Appli-
cations of Magnetic Resonance, Por-
torož, Yugoslavia, June 14-20, 1982

**A C-13 NMR Probe for High-Pressure and High-Temperature
Experiments**

Shigezo SHIMOKAWA and Eiji YAMADA

A high-pressure and high-temperature C-13 NMR probe for work in the temperature range from 20 to 600°C and pressure range from 1 to 1000 bar is reported. The sample cell has a capillary opening and the vessel was pressurized by inert gas. From the measurements of C-13 spectra of residue of thermal degradation of polyvinyl chloride, the process of the polycondensation of aromatic rings was directly observed. These results show that the C-13 nuclear magnetic resonance spectra contain more clear information than the corresponding proton spectra.