12th International Conference on Plasma Surface Interaction in Controlled Fusion Devices, Saint Raphael, France, May 20-24, 1996

Thermal response for divertor mock-up using surface-modified CFC tile

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It is necessary for the divertor plate to be actively cooled in order to remove the extremely high heat load from the fusion plasma. In this study the surface of CFC, CX-3002U, was converted to B_4C and SiC by using a chemical vapor reaction, CVR. The thermal response properties of divertor mock-ups made by these materials and CFC were examined. These mock-ups were irradiated by electron beams with heat flux up to 15 MW/m^2. The surface temperature rise of B_4C-converted CFC tile was the highest, and that of CFC lowest. This difference was consistent with the value of the thermal conductivity. The heat flux that increases the surface temperature to 1000°C was approximately 8, 10 or 11 MW/m^2 for B_4C-converted CFC, SiC-converted CFC or CFC, respectively. No deterioration in the heat transfer for each mock-up was found for the heat flux which increased the surface temperature to 1000°C.

13th Meeting of the International Collaboration on Advanced Neutron Sources October 11-14, 1995 Paul Scherrer Institute, 5232 Villigen PSI, Switzerland

RECENT PROGRESS IN DEVELOPING HIGH-EFFICIENCY CRYOGENIC MODERATORS

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Extensive experimental efforts have been devoted to develop high-efficiency cryogenic moderators for: (1) cold intense, (2) cold sharp, and (3) thermal sharp neutron pulses based on a composite moderator concept. Various ideas to enhance the cold neutron intensity have

been examined. New moderators, such as a decoupled composite moderator and a composite moderator with poisoned premoderator, have been proposed and tested in order to realize a narrower cold neutron pulse without sacrificing the peak height. At a longer wavelength region (say>6Å), the performance of the new moderator is close to that of a decoupled solid methane moderator.

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FURTHER OPTIMIZATION OF COUPLED LIQUID-HYDROGEN MODERATOR FOR INTENSE PULSED NEUTRON SOURCES

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Optimization studies for increasing cold neutron intensity from a coupled liquid-hydrogen moderator with a premodertor were performed. Optimal thickness of hydrogen moderator was found to be 5 cm. Be reflector-filter placed in front of the moderator chamber gave almost no intensity enhancement in a cold neutron region. Narrow beam extraction was effective for some instruments which view a small area of the moderator surface. Beam intensity decreased little by extracting netron beams from both side of the moderator in comparison with a single beam extraction.

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HIGH-EFFICIENCY CRYOGENIC MODERATOR SYSTEM FOR SHORT PULSE COLD-NEUTRON USE

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Two kinds of methods were examined to improve pulse shapes of cold neutrons from a coupled liquid-hydrogen moderator with a premoderator. One is to decouple a premoderator from the reflector and the other is to use a poisoned premoderator. In the former case, the pulse shapes became narrower with a slight decrease of pulse peak height by reducing the premoderator thickness. The pulse shape was further improved by using a poisoned premoderator.

International workshop on Long Pulse Spallation Neutron Sources June 24-27, 1996 Hahn Meitner Institute, Berlin, Germany

NEUTRONICS OF A COUPLED GROOVED LIQUID-HYDROGEN MODERATOR

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A coupled liquid-hydrogen moderator with premoderator is one of the most efficient cold moderators for a high power spallation neutron source, especially for a long pulse use. We examined various methods to increase cold neutron intensity from this moderator system; moderator thickness, Be filter-reflector, narrow beam extraction (partial enhancement). [1]

Succeedingly, we have experimentally studied neutronics of a coupled grooved liquid-

hydrogen moderator (12 cm in width, 12 cm in height and 9.4 cm in total thickness) with a 2 cm thick water premoderator at ambient temperature, buried in a graphite reflector of about 1 m^3. The moderator had four grooves with a depth of 4.7 cm and width of 1.5 cm. The cold neutron intensity increases with neutron wavelength. Intensity gains of cold neutrons relative to a reference flat one with 5 cm thick are not so large; about 1.10 at 4A and 1.28 at 10A. However, it is revealed from the measured spatial distributions that the cold neutron intensity from grooves are very higher than that from corresponding positions of the flat moderator; the maximum intensity gain is about 40%. This characteristics will be very useful for neutron scattering instruments which view a small part of a moderator (SANS, reflectometry, etc.).

The pulse shapes were also measured. In the pulse shapes small humps in rising sides were observed as in the case of a grooved solid methane moderator. [2] The hump will cause almost no trouble in the case of long pulse spallation neutron sources.

1996 International Congress on Radiation Protection (IRPA9) Vienna, Austria April, 14-19,1996

A Genetic Algorithm Approach to Optimization for the Radiological Worker Allocation Problem

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The worker allocation optimization problem in radiological facilities inevitably involves various types of requirements and constraints relevant to radiological protection and labor management. We have proposed a genetic algorithms (GAs) approach to this problem in Health Physics [70(2), 1996]. We present another evolutionary model for this problem, and mainly discuss the different effects of different "hard" constraints.

From the comparisons of these models, we found that the previous model gave the first feasible solution very quickly, while the present model estableshed the best solution than the previous one.

10th Internatinal Congress of Radiation Research, Würzburg, Germany, August 27-September 1, 1995

PULSE RADIOLYSIS-LASER FLASH PHOTOLYSIS STUDIES OF ARENE/HALOGEN ATOM COMPLEXES IN LIQUID HALOCARBONS

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The monophotonic chemical reactions of the diphenyl sulfide/X(X=Cl, Br) and mesitylene/X complexes have been studied by the combined pulse radiolysis-laser flash photolysis method. While no photochemistry is observed from the excited state of diphenyl sulfide/Cl complexes in CCl_4, permanent photobleaching induced by intermolecular hydrogen abstraction is observed in 1, 2-dichloroethane ($\Phi=0.05$) and in CCl_4 which contains an additive such as dichloromethane and cyclohexane. The excited state of mesitylene/Cl complexes undergoes solvent independent intramolecular hydrogen abstraction with a quantum yield of 0.10. On the other hand no photochemistry is observed from the excited states of the diphenyl sulfide/Br and mesitylene/Br complexes. The bond dissociation energy of H-Cl, H-Br, and C-H proved useful to recognize the dependence of the photochemical reaction modes on both solvents and halogens.