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On BOWDEN's Stick-Slip Lengths of Surface Friction

By

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The frequency distribution of the BOWDEN stick-slip lengths was investigated in its dependence on the melting point by means of chlorides and oxydes, since the melting points of these are lower and higher than that of the pure metal respectively.

I. Introduction.

In so-called stick-slip phenomena of the surface-friction between steel and a certain metal, F. P. BOWDEN *et al.*[1] found that the stick-slip interval length, i. e. the difference of the maximum and minimum friction coefficients, is the smaller as the higher is the melting point of that metal. The author reexamined by means of chloride and oxyde of metals BOWDEN's statement, on paying his attention to the fact that the melting points are higher generally in the sequence of chloride, pure metal and oxyde with exception of Pb and Sn only.

II. Experiment.

The experimental apparatus is the same as that in the investigation of the solid solubility effect of the metallic surface friction by K. UMEDA and the present author[2].

The following groups are examined. The temperatures bracketted are the melting points in °C.

$SnCl_2$ (247°)	Sn (232°)	SnO (1900°)
$PbCl_2$ (498°)	Pb (327°)	PbO (870°)
$ZnCl_2$ (318°)	Zn (418°)	ZnO (1980°)
$AlCl_3$ (190°)	Al (659°)	Al_2O_3 (2050°)
CuCl (430°) + $CuCl_2$ (630°)	Cu (1083°)	CuO (1148°)
$NiCl_2$ (1001°)	Ni (1445°)	NiO (1990°)
$FeCl_3$ (302°)	Fe (1535°)	Fe_2O_3 (1565°)

The pure metals are polished by means of emery papers of up to the finest No. 05. The chlorides are formed chemically on a ball of the corresponding pure metal by being put into chlorine gas. The oxydes are formed as coated films by heating a ball of the corresponding pure metal in open air.

III. Results.

The results are shown in Figs. 1–7 where the stick-slip interval lengths are taken as abscissa and their relative frequencies as ordinate.

Though these results are rather qualitative, they show that the BOWDEN's statement seems to hold only in the above mentioned sequence of compounds for each metal.

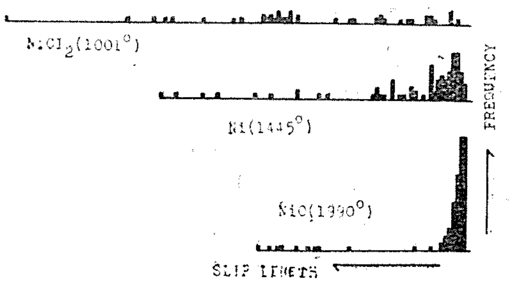

Fig. 1. Ni.

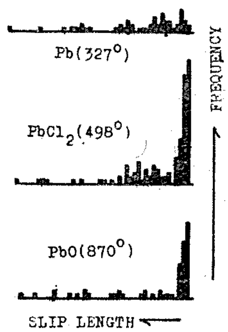

Fig. 2. Pb.

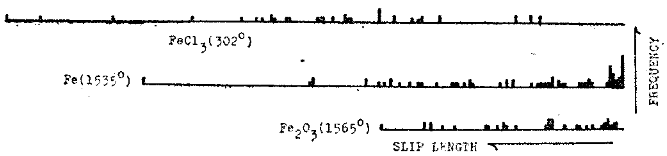

Fig. 3. Fe.

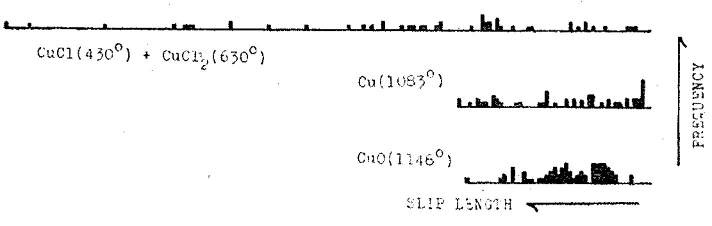

Fig. 4. Cu.

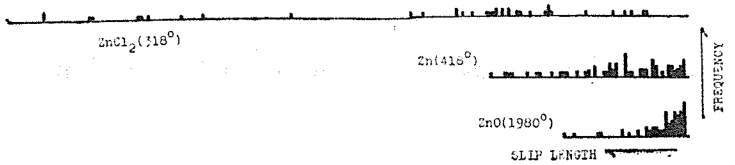

Fig. 5. Zn.

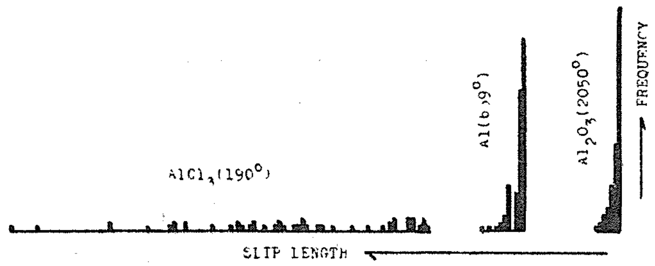

Fig. 6. Al.

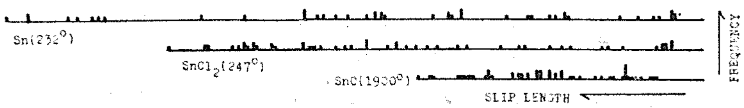

Fig. 7. Sn.

In conclusion, the author wishes to express his hearty thanks to Professor K. UMEDA for his kind advices and encouragements.

References.

(1) F. P. BOWDEN and L. LEBEN: *Proc. Roy. Soc. of London,* A, **169** (1939), 371.
(2) K. UMEDA and Y. NAKANO: *Journal of the Faculty of Science, Hokkaidô University,* 4 (1951), 70.

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