Lubrication Properties of Copper-Molybdenum Oxide Powders under High Temperature Conditions

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1. Introduction

We have studied friction and wear properties of aluminum bronze coated with MoO_3 powder slid against stainless steel under high temperature conditions [1)]. It was suggested that copper-molybdenum binary oxide composite $Cu_3Mo_2O_9$ was generated on the friction track during sliding at high temperature and acted as a high temperature lubricant.

In order to investigate the lubricity of this generated material, we studied lubrication properties of two kinds of copper-molybdenum oxide powders ($CuMoO_4$ and $Cu_3Mo_2O_9$) two kinds of single-metal oxide powders supplied between the stainless steel surfaces.

2. Experiment

$CuMoO_4$, MoO_3 and CuO powders are commercially available. $Cu_3Mo_2O_9$ powder was obtained by heating the mixture of MoO_3 and CuO powders in air at 700 °C for 1 hour. Stainless steel was tested as a disk and ring specimens. The sliding surface of ring specimen was slightly sandblasted with the alumina abrasives, and then each oxide powder was accumulated on the blasted surface as a powder coating.

The sliding test was conducted with the ring-on-disk apparatus with a furnace. The applied pressure was 0.46 MPa, the sliding speed of the ring specimen was 55 m/s, and the sliding distance was 200 m. The atmospheric temperature was controlled to be from the room temperature to 700 °C.

3. Results

Friction coefficients of non-coated specimen and four kinds of oxide powder coated specimens at each atmospheric temperature are shown in Fig. 1(a). Figure 1(b) shows the wear amount of each ring specimen.

MoO_3, $Cu_3Mo_2O_9$ and $CuMoO_4$ coated specimens showed higher friction coefficient comparing with non-coated specimen at room temperature. There was little difference in friction coefficient among all specimens at the temperature from 200 to 500 °C. Both of $Cu_3Mo_2O_9$ and $CuMoO_4$ coated specimens showed lower friction coefficient than other specimens at the temperature of over 500 °C. $Cu_3Mo_2O_9$ coated specimen showed the lowest friction coefficient of 0.32 at 700 °C. On the other hand, MoO_3 and CuO showed poor lubricating ability at the temperature of over 500 °C.

Wear amount of $Cu_3Mo_2O_9$ and $CuMoO_4$ coated specimens at 600 and 700 °C were quite small comparing with that of MoO_3 and CuO coated specimens. It was suggested that softening of $CuMoO_4$ at high temperature reduced friction coefficient of Cu-Mo coating [2)]. Beyond that, it was supposed that good adhesiveness of copper-molybdenum powder on the stainless steel at high temperature could be one of the reasons of excellent lubricating properties of them.

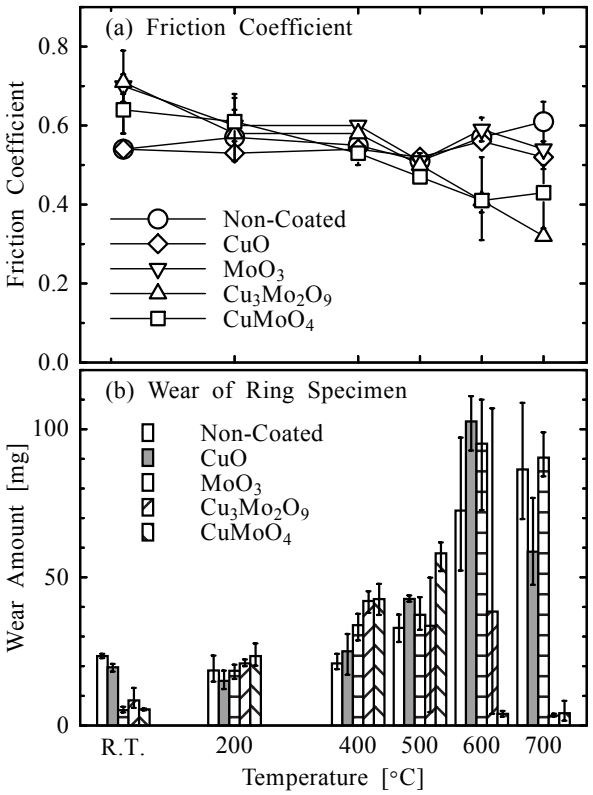

Fig.1 (a) Friction coefficient and (b) wear of ring specimen at each temperature.

4. Acknowledgment

This work was carried out supported by The Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. Grant-in-Aid for Young Scientists (B): 21760112.

5. References

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