

## **The lubricating effects of Fe<sub>2</sub>O<sub>3</sub> thin films under CO<sub>2</sub> environment**

**M. Y. PARK, Y. OYAMA, and S. MORI**

**Department of Applied Chemistry, Faculty of Engineering,  
Iwate University, 4-3-5 Ueda, Morioka 020-8551, Japan**

### **Abstracts**

In order to improve the tribological characteristics of metal oxide thin films under CO<sub>2</sub> environment, Fe<sub>2</sub>O<sub>3</sub> thin films have been deposited on Fe and SUS-304 substrates by metal organic chemical vapor deposition (MOCVD) and investigated their frictional and wear properties and the reactivities for tribochemical reaction. Fe<sub>2</sub>O<sub>3</sub> films have been deposited by MOCVD from ferrocene ( $\eta^5$ -C<sub>5</sub>H<sub>5</sub>) as the organic precursor at the ranging from 400 to 430°C. For Fe<sub>2</sub>O<sub>3</sub> films deposited on SUS-304 substrate, the dramatic improvements in friction and wear properties observed under CO<sub>2</sub> environment. This result represents that the frictional properties of Fe<sub>2</sub>O<sub>3</sub> films were strongly influenced the mechanical properties of substrate but also the reactivity on the tribochemical reaction. To investigate the tribochemical reactions on the frictional surfaces, X-ray photoelectron spectroscopy (XPS) and time of flight-secondary ion mass spectroscopy (TOF-SIMS) have been used. From the results of XPS and TOF-SIMS analyses, we identified that the carbonation reaction was actively occurred on the frictional surface of Fe<sub>2</sub>O<sub>3</sub>/Fe films and these different reactivities for the carbonation reaction are closely correlated with the increase of the friction coefficients.