LOW FRICTION MECHANISM OF CHLORINE-CONTAINING AMORPHOUS CARBON FILMS AGAINST ALUMINIUM ALLOY

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KEYWORDS
Diamond-like carbon films; Amorphous carbon films; Coating; Self-lubrication; Different element doping

INTRODUCTION
In our previous study, the effect of chlorine doping on tribological properties of amorphous carbon films against aluminium alloy were surveyed. As a result of friction test in non-lubricated conditions, the reduction of friction and improvement of wear properties of chlorine-containing amorphous carbon films could be observed. On the other hand, low friction mechanism was not clarified. The aim of this paper is to reveal the low friction mechanism of chlorine-containing amorphous carbon film in friction with aluminium alloy counterpart in non-lubricated condition.

EXPERIMENTAL SET UP & RESULTS
The hydrogenated amorphous carbon films and the chlorine-containing amorphous carbon films were deposited via the plasma based ion implantation and deposition (PBII&D) using $C_6H_5CH_3$ gas and C_2Cl_4 gas respectively. Friction test was performed under non-lubricated condition, and opposite material was φ6mm aluminium alloy (ISO-AlMg1SiCu) ball. As shown in Figure 1, friction coefficient of chlorine-containing amorphous carbon films indiceted lower friction coefficient compared with hydrogenated amorphous carbon films. This result means chlorine doping make it possible to improve friction properties of films. Figure 2 shows result of surface analysis using time-of-flight secondary ion mass spectroscopy (TOF-SIMS) on the wear track of chlorine-containing amorphous carbon films after the friction test. According to this result, several kinds of fragment ions, such as H_2OCl, H_2O_2Al, HAlCl, HOAlCl, H_2OAlCl could be detected from the wear track. It is possible to consider that there is some sort of hydrate composed of aluminium and chlorine at the sliding interface. This compound is thought to be tribofilms formed through tribochemical reaction between chlorine-containing amorphous carbon films and aluminium alloy. From the point of view about the tribofilm, we are going to report detail information about low friction mechanism of chlorine-containing amorphous carbon films

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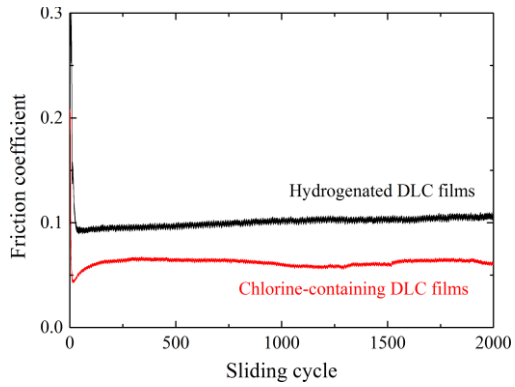

Figure.1 Comparison of friction coefficient

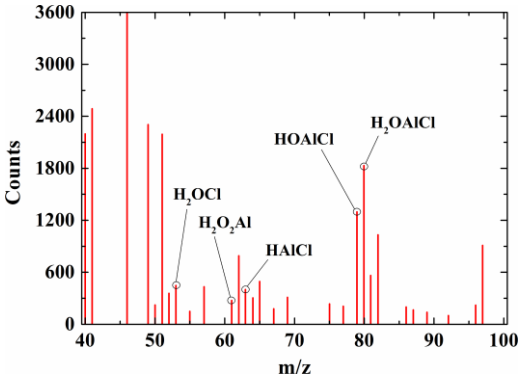

Figure.2 TOF-SIM analysis on the wear track of chlorin-containing amorphous carbon films