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The tribological performance of MoC1-x and a-C:H composites films by the plasma enhanced chemical vapor deposition under liquid lubrication system

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The cubic MoC_{1-x} and a-C:H composites which deposited by plasma enhanced chemical vapor deposition process using metal organic precursor as bis(tert-butylimido) bis(dimethylamido) molybdenum. Hydrogen as carrier gas and argon and nitrogen gases as reactive gas were used in deposition process, which in pulsed DC plasma at pressure of 5 Pa and temperature of 150 °C. This research focused to fine a feasibility for mechanical application on the automobile engine components through the investigation of tribological performance. Films were prepared on the nitrocarburized SCM435 steel which was material of automobile engine components. The films consisted composites of mixed cubic MoC_{1-x}, amorphous carbon, and small amount of MoN. The films measured high hardness as 21 GPa and showed a good adhesion as over 30N (HF1). Crystallization of carbide and nitride was determined by the x-ray diffraction method. The tribological friction performance were surveyed by the ball-on-disk tribometer with MoDTC contained lubricants. Especially in case of 0W20 lubricant, friction coefficient showed under 0.05, whereas base materials as nitrocarburized SCM435 had shown 0.09. For presence of sulfur and wear by additives, the chemical bonding states were analyzed on as deposited films and to test films by the XPS. The responsibility of protective coatings for automobile components was evaluated by the motoring rig operation system (Lambda 3.3, 5W30 MoDTC) for tappets, which supported real-time operations in automobile engine. As a results, the frictional torque of coated tappets with cubic MoC_{1-x} and a-C:H composites reduced 20% compared with uncoated tappets at 2,000 RPM.

Keywords
molybdenum
carbide
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