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Antagonism between advanced coatings and lubricants?

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ABSTRACT

Many hard coatings have been developed with the promise of reducing friction and wear. However, there is a lack of understanding of the compatibilities between these non-metallic coatings and commercial lubricants that were designed for ferrous alloys. Here, we present some interesting observations of selected coatings in lubricated environments. In one case, a steel ball slid was presented against a diamond-like carbon (DLC) coating in oils without and with anti-wear additives. While the DLC surface was literally intact in either lubricant, the steel ball wear surprisingly increased by 4× when a phosphate anti-wear additive (ZDDP) was present. Such an antagonistic effect was not observed for a boride coating or using a non-phosphate oil additive. In another case, an anti-friction piston skirt coating caused a significantly higher piston wear rate in a bench test lubricated by various diesel engine oils. Different wear mechanisms are proposed for the two cases and supported by morphology examination and composition analysis of the tribofilms formed on the contact surfaces and the wear debris generated in the tests.

KEYWORDS: coatings, lubricants, wear, antagonism