Tribological behaviour of fullerene-like MoS2 nanoparticles for different lubrication regimes in the presence of dispersants

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1. Introduction

In recent years, the advances in the field of nanoparticle synthesis have offered new possibilities in terms of lubricant additivation [1,2]. In this study, the tribological behaviour of a common base oil doped with fullerene-like MoS2 nanoparticles (IF-MoS2) was studied for different lubrication regimes. The use of nanoparticle additives is indeed known to be most effective for severe contact conditions [3], but the presence of particles in lubricants may also induce a risk of oil starvation for full-film lubrication regimes [4]. Today, the main challenge regarding nanoparticle-doped lubricants is to ensure a lasting dispersion of the nanoparticles, preventing agglomeration [5]. This problem was addressed here by testing different oil formulations, some of which containing dispersants. Friction coefficients and wear scars were observed for the different formulations, and surface analysis techniques were used to shed light on their tribological response.

2. Boundary lubrication

A High-Frequency Reciprocating Rig (HFRR) was used to create severe contact conditions. Whereas substantial friction and wear reduction was achieved in boundary lubrication when only nanoparticles were added to the lubricant, the presence of different quantities of dispersant reduced considerably the beneficial effects attributed to the IF-MoS2 (see Fig. 1).

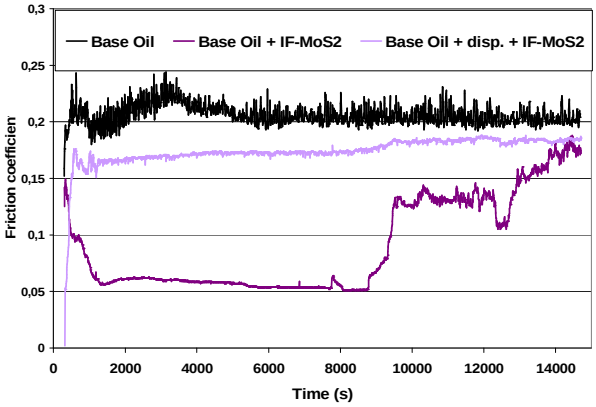

Fig. 1. Friction reductions obtained in the case of nanoparticle-doped base oil in the presence or not of dispersants.

3. Full-film lubrication

The risk of inducing oil starvation in the full-film lubrication regime when using nanoparticle-doped lubricants was explored with a Mini-Traction Machine (MTM). Different loads, rolling-sliding velocities and temperatures were tested and revealed the lack of influence of the presence of nanoparticles in the base oil when in full-film lubrication regimes. These results confirm the potential of these IF-MoS2 particles for a wide range of applications, as they proved harmless in the concentrations and size range tested.

4. Keywords

IF-MoS2, Nanoparticle additives, friction reduction, boundary lubrication, full-film lubrication, dispersants.

5. References

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