

EFFECT OF KINETICS OF MoS₂ SHEETS FORMATION AND ORGANIZATION ON TRIBOLOGICAL BEHAVIOR OF LUBRICATED CONTACTS USING MoDTC ADDITIVE

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ABSTRACT

Nowadays, energy saving through friction reduction is an important societal challenge. In case of boundary lubrication, molybdenum dithiocarbamates (MoDTC) molecules are known for their ability to reduce friction, this reduction being attributed to the formation of molybdenum disulfide (MoS₂) sheets on the rubbed surfaces [1]. It has been shown in the literature that for such contacts, a steady state regime, with friction coefficients between 0.04 and 0.065, is typically obtained, preceded by a transition period with higher friction coefficient, called “induction time” [2]. The aim of our study is to gain a better understanding of all phenomena that contribute to friction reduction, even during the induction period. Komaba et al. [2] have observed this induction time and they hypothesized that friction coefficient depends on the amount of MoS₂ sheets at the ball-flat interface. Nevertheless, others [3] have shown that the origin of low friction could also be attributed to the organization of MoS₂ sheets in the tribofilm.

In order to understand this induction time and the respective role of the two mentioned phenomena in reducing the coefficient of friction, our study focuses on the kinetics of MoS₂ sheets formation and their organization within the tribofilm during the tribological test, at several number of cycles (250, 540, 1400 and 18000). We use a Mo (VI) dithiocarbamate molecule that showed good lubricant performances in a previous study [4]. Tribological tests are carried out with a linear reciprocating ball-on-flat tribometer under boundary lubrication conditions. Raman characterizations are then carried out, followed by FIB-TEM and XPS characterizations on the balls and/or the flats, to confirm the presence of MoS₂ sheets within tribofilms and obtain information on their organization and their amount.

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