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On the nature of the coefficient of friction of DLC films deposited on rubber

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The deposition of a DLC film has been demonstrated to be an effective way to protect rubber substrates against wearing, and reduce the coefficient of friction (CoF) [1]. However, the origin of the growth of CoF during tribotests is not understood. This work aims at evaluating the relative importance of adhesive and hysteresis contributions as the main source of friction of DLC-protected rubbers.
Three different approaches were explored. From the theoretical side, an analytical model for the hysteresis contribution to friction for rubber substrates is presented [2]. From the experimental side, different tribotests have been carried out by modifying the contact load and the adhesive strength between the surface and the counterpart [3].
The results show that the variations of CoF during the tribotests under non-lubricated conditions are caused by the increase of the adhesive contribution to friction, which is stimulated by the growth of the contact area during the test. In the case of oil lubricating condition, the adhesive force is minimized and the CoF is observed to decrease during the tribotest. This is a consequence of the reduction of the viscoelastic contribution due to the elongation of the shape of the contact area, which is not negligible in a situation of reduced adhesion. The role of the microstructure of the DLC film on the efficiency of the oil lubrication will be discussed.
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Keywords
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