Abstract

Lubrication adjacent to the boundary has a considerable role in the life span of any of the two mating parts under liquid-lubricated conditions. This is generally a case observed during the initial start/stop cycles when inadequate amount of fluid is available to fully detach the surfaces in relative motion, thus resulting in increased wear of the surfaces. The main perspective of this work is to investigate the feasibility of using polymer coatings as boundary lubricants. Moreover, the study also explores the friction and wear properties of ultrahigh molecular weight polyethylene (UHMWPE) films coated on steel substrates under base oil lubricated conditions. The inclusion of different wt% of single- and multi-walled carbon nano tubes and graphene is done to enhance the load bearing capacity of the UHMWPE coatings. Experiments are conducted on a tailor-made tribometer making a point contact between a polymer coated cylindrical steel surface (shaft) and an uncoated steel ball as the counter face. Specific wear rates of the polymer films and bare steel surface under lubricated conditions are estimated. Stribeck curves have also been achieved to evaluate the effectiveness of the pristine UHMWPE and the nanocomposite coatings in the various regions of lubrication, especially the boundary lubrication regime.

The results show that the selected polymer coatings are effective in protecting the metallic surfaces without causing any observable oil contamination with wear debris. The coating demonstrated a very good wear life with a low value of the coefficient of friction.