Abstract

Despite the large bulk of work carried out on the tribological performance of polymers, there are areas of uncertainty and a need arises for further experimental investigations and analytical modeling for friction and wear of polymers. In the present work, a detail program with three polymers of smooth molecular profiles, namely UHMWPE, HDPE and PTFE, one normal polymer PP and one amorphous polymer PMMA was taken up in order to investigate the influence of different material and surface parameters on the friction, wear and temperature rise at the contact between the polymer sliding against metal surfaces. From the large bulk of experimental results a numbers of conclusions have been made, some of which confirmed earlier observations and some indicated novel findings. Iso-wear, iso-friction and iso-therms in load-speed coordinates for all the polymers tested were provided and these would serve as good design charts for the practicing engineers.

Existing wear models hitherto are based on empiricism and the wear equations are obtained by fitting experimental data. Only a few analytical approaches to develop wear models were made but they are not comprehensive enough to be used as predicting tools. In the present work an attempt was made to develop a comprehensive analytical model for predicting wear of polymers taking into account the influence of most of the material and surface properties and operating variables. These predictions are of practical importance and they agree well with experimental results.

Some polymer composites of HDPE and UHMWPE reinforced with varying percentages of hydroxyapatite were developed. These composites are expected to be useful in orthopedic and other applications for their enhanced bio-compatibility. The tribological performances of these materials were evaluated and it was found that the new composites are more wear resistant than their parent material.