

Abstract

Improving the wear resistance of materials subject to friction and sliding wear plays an important role in extending the life cycles of equipment used for demanding applications. The focus of this project was to systematically investigate the friction and sliding wear characteristics of three grades of WC-Co alloys to which refractory carbides TiC, TaC and NbC were added. The wear behaviour was characterized by sliding the carbide alloys against two grades of steel in a pin-on-disc configuration and determining the associated wear mechanisms. The influence of applied load and sliding velocity on the friction and wear response was also analyzed. The 304 stainless steel sliding pairs experienced 50% more friction than the bright mild steel sliding pairs under all operating conditions. An increase in load caused a non-linear decrease in friction while an increase in sliding velocity did not have a significant effect. The WC-Co alloy to which small amounts of TaC and NbC were added was found to have the highest wear resistance under all the operating conditions tested. The wear mechanisms for the steels were predominantly smearing and groove formation caused by ploughing of the wear particles. The predominant wear mechanisms for the cemented carbides were preferential binder removal, followed by carbide grain cracking and carbide grain pull-out with the occasional tribofilm.