World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

# Effect of Roughness and Microstructure on Tribological Behaviour of 35NCD16 Steel

**Authors :** A. Jourani, C. Trevisiol, S. Bouvier

**Abstract :** The aim of this work is to study the coupled effect of microstructure and surface roughness on friction coefficient, wear resistance and wear mechanisms. Friction tests on 35NCD16 steel are performed under different normal loads (50-110 N) on a pin-on-plane configuration at cyclic sliding with abrasive silicon carbide grains ranging from 35 µm to 200 µm. To vary hardness and microstructure, the specimens are subjected to water quenching and tempering at various temperatures from 200°C to 600°C. The evolution of microstructures and wear mechanisms of worn surfaces are analyzed using scanning electron microscopy (SEM). For a given microstructure and hardness, the friction coefficient decreases with increasing of normal load and decreasing of the abrasive particle size. The wear rate increase with increasing of normal load and abrasive particle size. The results also reveal that there is a critical hardness $Hc_{critical}$ around 430 Hv which maximizes the friction coefficient and wear rate. This corresponds to a microstructure transition from martensite laths to carbides and equiaxed grains, for a tempering around 400°C. Above $Hc_{critical}$ the friction coefficient and the amount of material loss decrease with an increase of hardness and martensite volume fraction. This study also shows that the debris size and the space between the abrasive particles decrease with a reduction in the particle size. The coarsest abrasive grains lost their cutting edges, accompanied by particle damage and empty space due to the particle detachment from the resin matrix. The compact packing nature of finer abrasive papers implicates lower particle detachment and facilitates the clogging and the transition from abrasive to adhesive wear.

**Keywords :** martensite, microstructure, friction, wear, surface roughness
**Conference Title :** ICSRD 2020 : International Conference on Scientific Research and Development
**Conference Location :** Chicago, United States
**Conference Dates :** December 12-13, 2020