World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:11, No:02, 2017

# Simple and Effective Method of Lubrication and Wear Protection

**Authors :** Buddha Ratna Shrestha, Jimmy Faivre, Xavier Banquy

**Abstract :** By precisely controlling the molecular interactions between anti-wear macromolecules and bottle-brush lubricating molecules in the solution state, we obtained a fluid with excellent lubricating and wear protection capabilities. The reason for this synergistic behavior relies on the subtle interaction forces between the fluid components which allow the confined macromolecules to sustain high loads under shear without rupture. Our results provide rational guides to design such fluids for virtually any type of surfaces. The lowest friction coefficient and the maximum pressure that it can sustain is 5*10-3 and 2.5 MPa which is close to the physiological pressure. Lubricating and protecting surfaces against wear using liquid lubricants is a great technological challenge. Until now, wear protection was usually imparted by surface coatings involving complex chemical modifications of the surface while lubrication was provided by a lubricating fluid. Hence, we here research for a simple, effective and applicable solution to the above problem using surface force apparatus (SFA). SFA is a powerful technique with sub-angstrom resolution in distance and 10 nN/m resolution in interaction force while performing friction experiment. Thus, SFA is used to have the direct insight into interaction force, material and friction at interface. Also, we always know the exact contact area. From our experiments, we found that by precisely controlling the molecular interactions between anti-wear macromolecules and lubricating molecules, we obtained a fluid with excellent lubricating and wear protection capabilities. The reason for this synergistic behavior relies on the subtle interaction forces between the fluid components which allow the confined macromolecules to sustain high loads under shear without rupture. The lowest friction coefficient and the maximum pressure that it can sustain in our system is 5*10-3 and 2.5 GPA which is well above the physiological pressure. Our results provide rational guides to design such fluids for virtually any type of surfaces. Most importantly this process is simple, effective and applicable method of lubrication and protection as until now wear protection was usually imparted by surface coatings involving complex chemical modifications of the surface. Currently, the frictional data that are obtained while sliding the flat mica surfaces are compared and confirmed that a particular mixture of solution was found to surpass all other combination. So, further we would like to confirm that the lubricating and antiwear protection remains the same by performing the friction experiments in synthetic cartilages.

**Keywords :** bottle brush polymer, hyaluronic acid, lubrication, tribology
**Conference Title :** ICNN 2017 : International Conference on Nanoscience and Nanotechnology
**Conference Location :** Venice, Italy
**Conference Dates :** February 16-17, 2017