TRIBOLOGICAL PROPERTIES OF POLY(IONIC LIQUID) BRUSHES IN ORGANIC AND AQUEOUS MEDIA

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There are few publications evaluating polymer brushes in two types of solvent, such as organic and aqueous solvents, and there are even fewer papers evaluating surface grafted poly(ionic liquids) for its ability to reduce friction. This study evaluates the friction reducing capabilities of an Imidazolium based poly(ionic liquid) brush grafted onto a silicon wafer using surface initiated atomic radical transfer polymerisation (ATRP) against borosilicate glass in both dodecane and water. The samples were tested as a function of the polymerisation time as well as changing functional groups on the Poly(ionic liquid).

Using a macroscopic tribometer the friction coefficient was measured as a function of polymerisation time as shown in Figure 1 and a reduction of friction was seen in both dodecane and water, though the reduction in friction exhibited in dodecane was more significant than that in water. This implies that the surface grafted poly(ionic liquid) brushes could be well solvated by both aqueous and organic solvents. Atomic force microscopy imaging was carried out in water to view the morphology of the film in the aqueous solvent to examine why a more minor reduction of friction is seen. Some brush like features are seen for the samples with polymerisation times of 5 h and 9 h and 7 h but not polymerisation times of 3 h which matches with the friction coefficient seen in water.

To further verify these observations force curves with a borosilicate glass colloidal particle will be carried out to assess the ‘pull-off’ adhesion force of these samples and how they relate to friction coefficient. Also, imaging of the samples in dodecane should be carried out to compare that with the water imaging and see if that can explain differences seen in friction coefficient.

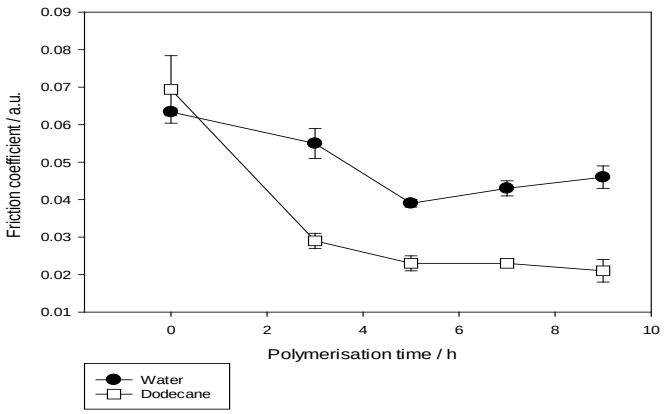

Figure 1- Graph plotting the friction coefficient measured between the PIL brush samples and a borosilicate glass sphere with a normal load of 100 g and a sliding speed of 0.5 mm s^{-1}.

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