Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Lubrication by glycoprotein brushes. BRUNO ZAPPONE, UCSB, MARINA RUTHS, UMass Lowell, GEORGE W. GREENE, UCSB, JACOB ISRAELACHVILI, UCSB — Grafted polyelectrolyte brushes show excellent lubricating properties under water and have been proposed as a model to study boundary lubrication in biological system. Lubricin, a glycoprotein of the synovial fluid, is considered the major boundary lubricant of articular joints. Using the Surface Force Apparatus, we have measured normal and friction forces between model surfaces (negatively charged mica, positively charged poly-lysine and aminothiol, hydrophobic alkanethiol) bearing adsorbed layers of lubricin. Lubricin layers acts like a versatile anti-adhesive, adsorbing on all the surfaces considered and creating a repulsion similar to the force between end-grafted polymer brushes. Analogies with polymer brushes also appear from bridging experiment, where proteins molecules are end-adsorbed on two opposing surfaces at the same time. Lubricin 'brushes' show good lubricating ability at low applied pressures (P<0.5MPa), especially on negatively charged surfaces like mica. At higher load, the adsorbed layers wears and fails lubricating the surfaces, while still protecting the underlying substrate from wearing. Lubricin might thus be a first example of biological polyelectrolytes providing 'brush-like' lubrication and wear-protection.

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Date submitted: 04 Dec 2005 Electronic form version 1.4