Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Mesh Size Control of Friction ANGELA PITENIS, JUAN MANUEL URUENA, KYLE D. SCHULZE, ANDREW C. COOPER, THOMAS E. ANGELINI, W. GREGORY SAWYER, Univ of Florida - Gainesville — Soft, permeable sliding interfaces in aqueous environments are ubiquitous in nature but their ability to maintain high lubricity in a poor lubricant (water) has not been well understood. Hydrogels are excellent materials for fundamental soft matter and biotribology studies due to their high water content. While mesh size controls the material and transport properties of a hydrogel, its effects on friction were only recently explored. Polyacrylamide hydrogels slid in a Gemini (self-mated) interface produced low friction under low speeds, low pressures, macroscopic contact areas, and room temperature aqueous environments. The friction coefficients at these interfaces are lowest at low speeds and are speed-independent. This behavior is due to thermal fluctuations at the interface separating the surfaces, with water shearing in this region being the main source of dissipation. We found that mesh size had an inverse correlation with friction. We further investigated a transition from this behavior at higher speeds, and found that the transition speed correlated with the mesh size and relaxation time of the polymer network. Very soft and correspondingly large mesh size Gemini hydrogels show superlubricity under specific conditions with friction being less than 0.005.

Angela Pitenis
Univ of Florida - Gainesville

Date submitted: 06 Nov 2015 Electronic form version 1.4