Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Molecular mechanisms of friction at soft polymer interfaces[1]
FREDERIC RESTAGNO, CELINE COHEN, CHRISTOPHE POULARD, LILIANE LEGER, Laboratoire de physique des solides - CNRS/Univers. Paris-Sud
— Polymer molecules strongly anchored to a solid substrate and interdigitated into bulk crosslinked elastomer have been shown recently to efficiently promote adhesion and friction between substrate and elastomer. Concerning friction, the regime of low surface coverage in surface anchored chains has been fully and quantitatively accounted for by the pull off mechanisms, where individual chains are dynamically extracted from the elastomer. Then, the stretching energy of these chains dominates the friction losses. We focus here on the dense surface coverage regime. We present systematic experiments performed on the polydimethylsiloxane (PDMS) - silica system, and determine molecular weight and sliding velocity dependences of the friction stress. We show that the friction is dominated by the shear thinning of the grafted layer confined between the elastomer and the substrate, and responding to the shear solicitation like a melt, but with very long relaxation times. We also show that the friction stress appears highly sensitive to the molecular organization inside the surface anchored polymer layer, comparing end grafted and strongly adsorbed layers having otherwise the same molecular characteristics (molecular weight of the chains, and thickness of the surface anchored layer).

[1]We thank the RTRA "Triangle de la physique" for financial support.

Frederic Restagno
Laboratoire de physique des solides - CNRS/Univers. Paris-Sud

Date submitted: 07 Dec 2011 Electronic form version 1.4