Abstract Submitted
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A Mean Field Theoretic Study of Friction between Polyelectrolyte Polymer Brushes[1] JEFFREY SOKOLOFF, Northeastern University — It is proposed that the fluctuations from the mean field theoretic parabolic monomer density profile for polymer brushes will result in a type of static friction between two polymer brush coated solid surfaces, which results from polymers that fluctuate out of the parabolic density profile belonging to one brush and get entangled with polymers belonging to the second brush. This occurs when the brushes are pushed together with a sufficiently large normal force so that the monomer density in the interface region separating the two polymer brushes is in the semidilute regime. The friction is not the usual static friction, in that when a force below this "maximum force of static friction" is applied, there is a "creep velocity" which is as large as a few millimeters per hour. At sufficiently light load so that the monomer density is in the dilute regime, the "static friction" goes away and there only exists a viscous kinetic friction (i.e., kinetic friction proportional to the sliding velocity) between the brushes. When the polymers are electrically charged, the counter ions produce additional osmotic pressure to support the load. Calculations of this additional load carrying mechanism using a Debye-Huckel theory treatment due to Miklavic and Marcelja, predict that the counterions do not provide a significant additional contribution to load carrying ability of polymer brushes.

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