Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Viscous-elastic interaction as a mechanism to create adhesion in frogs' toe pads AMIR GAT, ARIE TULCHINSKY, Technion - Israel Institute of Technology — The toe pads of frogs consist of soft hexagonal structures and a network of channels between and within the soft structures, containing a viscous liquid. It has been hypothesized that this configuration creates adhesion by allowing for long range capillary forces, or alternatively, that the channel network allows for exit of the viscous liquid and thus improve contact of the toe pad. In this work we suggest interaction between viscous flow and elastic forces as a mechanism to create temporary adhesion, even in the absence of capillary or van der Waals forces. We study the dynamics of a solid body covered with an array of protruding elastic cylinders, immersed within a viscous liquid, and pressed against a flat surface. Inertia is neglected and the elastic-viscous dynamics yield the governing differential equation describing the relative motion between the body and the surface. The compressed elastic cylinders apply a force acting to separate the solid body from the surface. The relative motion between the body and the surface creates a viscous flow and pressure field resisting the elastic force and significantly reducing the speed of separation. We show that the viscous-elastic interaction can prevent motion tangential and normal to the surface and can create temporary adhesion.

Amir Gat
Technion - Israel Institute of Technology

Date submitted: 30 Jul 2013 Electronic form version 1.4