Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Novel microfluidic diodes: one-way wicking in open micro-channels controlled by channel topography[1] JIANSHENG FENG, JONATHAN ROTHSTEIN, UMass Amherst, UMASS AMHERST TEAM — A series of open microfluidic channels with specially designed asymmetric internal structures were fabricated using standard photo-lithography and soft molding techniques. These micro-channels were shown to produce an asymmetric wicking behavior for a series of IPA-water mixtures. In some cases, the test liquids were found to completely wick in one direction while not wicking at all in the opposite direction. The wicking speed and degree of asymmetry was affected by the contact angle of the wicking fluid and the specific geometry of the angled fin-like structures added to the sides of the micro-channels. Surface-tension effects induced by the presence of the channels' internal structures were found to be the dominating physical mechanism responsible for the observed wicking behavior. Numerical simulations were performed to investigate the interface profile developed by the liquid front as it wicked through the channels. These simulations showed that three-dimensional effects were important in determining the extent and speed of wicking in these micro-channels. The findings of this study are expected to provide a better understanding of how fluids interact with micro-scaled structures and to offer a new way of manipulating fluids at the micron and nanometer scale.

[1]This work was supported by National Science Foundation's Center for Hierarchical Manufacturing (Grant number: CMMI-1025020)

Jiansheng Feng
UMass Amherst

Date submitted: 12 Aug 2012 Electronic form version 1.4