

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Crumpling in densely perforated membranes¹ DAVID YLLANES, Syracuse University, MARK BOWICK, Syracuse University and KITP — An outstanding problem in the statistical mechanics of two-dimensional membranes is a predicted crumpling transition when the bending stiffness is of the order of kT (i.e., at a temperature much higher than the experimentally accessible regime). We propose a mechanism to tune this transition by modifying the bending stiffness of a graphene sheet through geometry. We have carried out extensive molecular dynamics simulations of perforated sheets with a dense array of holes and observed that the transition can be tuned by the fraction of removed area. The dependence of the transition point on the removed area is very strong but not sensitive to the particular arrangement of the holes. In addition, we have found that anisotropic arrays of holes produce two transition temperatures. The lower transition temperature corresponds to crumpling in only one dimension, along the easier axis, before the sheet crumples completely. The first anisotropic crumpling occurs at a significantly lower temperature and, therefore, adjusting the degree of anisotropy in the perforations may help bridge the gap to the experimentally accessible regime.

¹This research was supported by the NSF through the DMREF grant DMR-1435794 and DMR-1435999

David Yllanes
Syracuse University

Date submitted: 11 Nov 2016

Electronic form version 1.4