Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Biomimetic Thermo-Responsive Polymer Nano-Composites. JOAO MAIA, SHAGHAYEGH KHANI, ELVIS CUDJOE, Case Western Reserve University, STUART ROWAN, University of Chicago, CASE WESTERN RESERVE UNIVERSITY TEAM, UNIVERSITY OF CHICAGO TEAM — Responsive polymer nano-composites have been fabricated with an inspiration from the defense mechanism of sea cucumbers, whose mechanical properties undergo a dramatic change upon exposure to an external stimulus. In order to make nano-composites that mimic this behavior, polymers with LCST behavior were grafted onto CNC nano-rods and subsequently incorporated into a viscoelastic matrix. The material was then found to show thermal stiffening properties upon exposure to a temperature above the LCST transition point and it was hypothesized that this transition is due to formation/breakage of a network that happens as a result of switching on/off the attractive interactions between the hydrophilic nano-rods. In the present study, we develop a mesoscale simulation model in order to study the same system and examine the validity of this hypothesis. Using Energy Conserving Dissipative Particle Dynamics we will monitor the structural changes in the system as the temperature is increased above the LCST point. Our results show that upon the collapse of the grafted chains in response to temperature, attractive interactions between the nano-rods are switched on and a network is formed. These findings are in agreement with the experimental results and confirm the proposed structural model.

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Date submitted: 11 Nov 2016 Electronic form version 1.4