Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Creating a "Repair and Go" System by Using Nanoparticle-filled Microcapsules GERMAN KOLMAKOV, University of Pittsburgh, TODD EMRICK, THOMAS RUSSELL, ALFRED CROSBY, University of Massachusetts, ANNA BALAZS[1] — Using a hybrid computational approach, we simulate the behavior of nanoparticle-filled microcapsules that are propelled by an imposed shear to move over a substrate, which encompasses a microscopic crack. When the microcapsules become localized in the crack, the nanoparticles can tunnel through the capsule's shell to bind to and fill the damaged region. Initially focusing on a simple shear flow, we isolate conditions where the microcapsules become arrested in the cracks and those where the capsules enter the cracks for a finite time, but are driven to leave this region by the imposed flow. We also characterize the particle deposition process for these two scenarios, showing that the deposition is greater for the arrested capsules. We then determine the effect of utilizing a pulsatile shear flow and show that this flow field can lead to an effective "repair- and-go" system where the micro-carriers not only deliver a high volume fraction of particles into the crack, but also leave the fissure and thus, can potentially repair additional damage within the system.

[1]University of Pittsburgh

German Kolmakov
University of Pittsburgh

Date submitted: 21 Dec 2009 Electronic form version 1.4