Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

A two-phase theory for non-Newtonian suspensions CHRISTOS VARSAKELIS, SABIC — In this talk, a continuum and thermodynamically consistent theory for macroscopic particles immersed in a non-Newtonian fluid is presented. According to the employed methodology, each phase of the mixture is treated as a thermodynamic system, endowed with its own set of thermodynamic and kinetic variables, and is required to separately satisfy the equations for the balance of mass, momentum and energy. As both constituents of the mixture are not simple fluids, additional degrees of freedom are introduced for the proper description of their thermodynamic state. A subsequent exploitation of the entropy inequality asserts that the accommodation of the complicated rheological characteristics of both phases requires a departure from a linear current-force relationship. For this reason, a subtle nonlinear representation of the stress tensors is employed. Importantly, the inclusion of additional degrees of freedom allows us to obtain a rate equation for the evolution of the volume fraction of the particulate phase. Following a delineation of the fundamentals of the proposed theory, the talk concludes with the presentation of some limiting cases that also serve as preliminary, sanity tests.

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Date submitted: 11 Nov 2016 Electronic form version 1.4