**DERIVING A CONSTITUTIVE MODEL FOR PREDICTING THE RHEOLOGICAL RESPONSE OF DRUG-CARRYING PARTICLES**

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**ABSTRACT**

In the past few decades, nanotechnology has been employed to provide breakthroughs in the diagnosis and treatment of several diseases using drug-carrying particles (DCPs). [1] In such an endeavor, the optimal design of DCPs is paramount, which necessitates the use of an accurate and trustworthy constitutive model in computational fluid dynamics (CFD) simulators. We herein introduce a continuum model to predict the rheological response of suspensions of DCPs in blood [2]. The model is developed using non-equilibrium thermodynamics [3] to guarantee thermodynamic admissibility. Red blood cells (RBCs) are modeled as deformed droplets with a constant volume that are able to aggregate; this is accomplished by using two structural variables: a constrained contravariant second-rank tensor, $\overbar{S}$, such that $det\overbar{S}$ is equal to the volume of an RBC, to characterize the deformation of RBCs, [4] and an additional structural variable, $λ$, to properly characterize the network formed by RBCs, leading to the exhibition of a yield stress [5]. Next, we consider particles as rigid spheroids whose orientation is characterized via an orientation tensor constrained to have a constant trace (due to particle rigidity). The model predictions are compared favorably against rheological data for both spherical and non-spherical particles immersed in non-aggregating blood [6]. Our model’s use in CFD simulations will allow the execution of in silico trials for the testing of DCPs in virtual patients.

**KEYWORDS:** Blood, Non-equilibrium thermodynamics, Particle, Viscosity, Normal stresses

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