Abstract Submitted
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The Effect of Rigid Cells on Blood Viscosity: Linking Rheology and Sickle Cell Anemia[1] ZHE FENG, University of Notre Dame, ANTONIO PERAZZO, Princeton University, YUAN-NAN YOUNG, New Jersey Institute of Technology, DAVID WOOD, University of Minnesota, JOHN HIGGINS, Massachusetts General Hospital, ZHANGLI PENG, University of Notre Dame, HOWARD STONE, Princeton University — Sickle cell anemia (SCA) is a disease that affects red blood cells (RBCs) within blood. Healthy RBCs are highly deformable objects that under flow can penetrate blood capillaries smaller than their typical size. In SCA there is an impaired deformability of some cells, which are much stiffer and with a different shape than healthy cells, and thereby affect regular blood flow. It is known that blood from patients with SCA has a higher viscosity than normal blood. However, it is unclear how the rigidity of cells is related to the viscosity of blood, in part because SCA patients are often treated with transfusions of variable amounts of normal RBCs and only a fraction of cells will be stiff. Hence, we report systematic viscosity measurements and numerical simulations of a suspension varying the fraction of RBCs affected by increased rigidity within a suspension of healthy cells. Our results show that there is a rheological signature within blood viscosity to clearly identify the fraction of rigidified cells within healthy deformable cells down to a 5% volume fraction of rigidified cells. These results are relevant to better characterize SCA, provide useful insights relevant to blood transfusions, and, more generally, extend to the rheology of mixed suspensions having particles with different rigidities, as well as offering possibilities for developments in the field of soft material composites.

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