MODELING THE SHEAR-INDUCED MIGRATION OF RED BLOOD CELLS UNDER PHYSIOLOGICAL CONDITIONS

P. Polydorou[1], E. Kaliviotis[2], P. S. Stephanou[1,*]

[1]Department of Chemical Engineering, Cyprus University of Technology, Limassol, 3036, Cyprus

[2]Department of Mechanical Engineering and Materials Science and Engineering, Cyprus University of Technology, Limassol, 3036, Cyprus

(*pavlos.stefanou@cut.ac.cy)

ABSTRACT

Red blood cells (RBCs) in physiological conditions are capable of deforming and aggregating[1]. However, both deformation and aggregation are seldom considered together when modeling the rheological behavior of blood. Recently, we proposed a series of rheological models that can make quantitative predictions against available experimental data[2,3]. However, these models should be generalized to account for RBC migration effects and RBC–plasma interactions occurring in microvessels. In the present work, we derive a refined constitutive model via the use of the GENERIC formalism[4] of non-equilibrium thermodynamics (NET). Our starting point is the shear-induced migration model proposed by Phillips et al.[5] The attractive advantage of employing a NET formalism is that the resulting constitutive model is, by construction, consistent with the laws of thermodynamics. The constitutive model proposed provides predictions for the rheological properties of these fluids, which will be compared against available experimental data.

KEYWORDS: shear-induced migration, red blood cells, non-equilibrium thermodynamics, GENERIC

REFERENCES

[1] Mansour M H, Bressloff N W, Shearman C P. (2010). *Biorheology,* 47, 73–93.
[2] Stephanou P S, Tsimouri I Ch. (2020). *Soft Matter*, 16, 7585.
[3] Stephanou P S. (2020). *Phys. Fluids*, 32, 103103.
[4] Öttinger H C. (2005). *Beyond Equilibrium Thermodynamics,* Hoboken, New Jersey, John Wiley and Sons.
[5] Phillips R J, Armstrong R C, Brown R A, Graham A L, Abbott J R. (1992). *Phys. Fluids,* 4, 30–40.