Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Red blood cell dynamics under high shear rates: in vitro experimental investigations LUCA LANOTTE, CYRILLE CLAUDET, Laboratoire Charles Coulomb, Université Montpellier 2 (France) - Centre de Biochimie Structurale, CNRS (France), JEAN-MARC FROMENTAL, Laboratoire Charles Coulomb, Université Montpellier 2 (France), MANOUK ABKARIAN, Laboratoire Charles Coulomb, Université Montpellier 2 (France) - Centre de Biochimie Structurale, CNRS (France) — The full understanding of red blood cell (RBC) dynamics is an intriguing challenge that involves transversal branches of science. Despite the potential impact that it could have on medical research and industrial applications, a systematic study of RBCs response under significant shear rates ($200<\dot{\gamma}<3000$ s^{-1}) is still lacking in scientific literature. In this work, in vitro experiments of microfluidics and rheometric measurements are combined to investigate mechanical properties of highly sheared RBCs. By high-speed microscopy, we investigated RBCs flow through rectangular channels in unconfined conditions. In parallel, RBCs suspensions of different hematocrits have been processed by a cone-plate rheometer and subsequently observed by optical microscopy to ensure reliability to the experimental results. The outcomes of both microfluidics and rheological approaches clearly show the presence of strongly deformed shapes, in addition to the expected elongated ellipsoids. Plausible explanations for formation and stability of these striking highly deformed shapes are here proposed.

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Date submitted: 28 Jul 2014 Electronic form version 1.4