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Mechanical Response of Red Blood Cells Entering a Constriction: Influence of Oxidative Stress N.F. ZENG, W.D. RISTENPART, Dept. Chemical Engineering and Materials Science, Univ. California Davis — A key determinant of RBC deformability is the level of oxidative stress, i.e., the imbalance of reactive oxygen species (ROS) associated with many disease states. Previous work has shown that oxidative stress rigidifies RBC membranes, but little is known about the mechanical response of RBCs to oxidative stress under physiological shear conditions. Here we show that oxidative stress significantly alters the dynamic mechanical behavior of RBCs undergoing a sudden increase in shear stress. Using high speed video, we tracked the motion of RBCs entering a narrow constriction in a microfluidic channel. Varied concentrations of hydrogen peroxide, a generator of ROS, were added to the RBCs to induce oxidative stress. We demonstrate that an H2O2 concentration as low as 30μM significantly decreases the percentage of RBCs undergoing stretching and twisting motions, while simultaneously increasing the percentage of RBCs undergoing tumbling motions. A key observation is that the H2O2 treatment reduced the average RBC volume by up to 30%, suggesting that an increase in intracellular viscosity increased the propensity for RBCs to tumble.

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