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Segregation of Defects at Grain Boundaries. AHMED M. ALSAYED, ARJUN G. YODH, University of Pennsylvania — Interstitial impurity segregation at grain boundaries plays an important role in materials properties such as cohesion, grain growth kinetics, and transport. Unfortunately, direct measurement of grain boundary composition is difficult in bulk crystals and polycrystals. In this contribution we directly study impurity segregation at grain boundaries using a model colloidal crystal. The polycrystals are made of temperature-sensitive micron size NIPA microgel particles [1]. We add 100-200 nm fluorescent polystyrene particles to this system to model interstitial impurities. The impurities are then tracked using video microscopy close to and far from the grain boundaries. We find that impurities hop from one position to another and diffuse anisotropically when far from the grain boundaries, and they diffuse isotropically in the grain boundaries. Upon increasing the temperature, the packing volume fraction of NIPA particles decreases and grain boundaries start to melt. We also explored the effects of the segregated impurities on grain boundary melting. [1] A. M. Alsayed, M. F. Islam, J. Zhang, P. J. Collings, A. G. Yodh, Science 309, 1207 (2005). This work was supported by grants from NSF (DMR-0505048 and MRSEC DMR05-20020) and NASA (NAG8-2172).

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