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In-Situ TEM Characterization and Molecular Dynamics Simulation of the Microstructural Response of Nanocrystalline Gold to Rapid Thermal Annealing

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Understanding a material's response to extreme thermal conditions is important for a range of processing and applications ranging from microelectronics production to space explorations. This work focuses on the response of nanocrystalline Au as a model face-centered cubic (FCC) metal to probe microstructural behavior during extreme thermal annealing. In-situ TEM laser heating was used in tandem with cryogenic cooling to rapidly heat and quench Au films. Bright field TEM images and precession enhanced automated crystallographic orientation maps (ACOM) will be shown before and after heating to demonstrate the effects of thermal cycling on the microstructure and grain boundary (GB) evolution of the films. These experiments are correlated with molecular dynamics (MD) simulations to provide insights into the nanoscale GB mechanisms underlying the microstructural response and further guide experimental analysis to uncover GB network responses during microstructural evolution.