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Characterizing Crystallization at Higher Temperatures in Nanolayered Dielectric Coatings to Improve Mirrors in Gravitational-Wave Detectors BHAVNA NAYAK, SETH LINKER, TIM BENNETT, JOHN TAMKIN, California State University, Los Angeles, JOSHUA NEILSON, University of Sannio, Benevento, BRECKEN LARSEN, STEPHAN LEBOHEC, University of Utah, Salt Lake City, HARRY THEMANN, YANGYANG LIU, MARINA MONDIN, California State University, Los Angeles, RICCARDO DESALVO , RicLab, LLC, LIGO COLLABORATION — Gravitational waves emitted from massive astrophysical events induce a strain in spacetime that stretches our detectors by 10^{-19}m. Since the detectors need high sensitivity to detect this distortion, there's an urgent need to limit sources of noise, one such being the mirror coatings in the detectors. Imperfections like crystalline regions in uniform glassy coatings act as scatterers and greatly reduce sensitivity to gravitational waves either by direct loss of light or by mechanical dissipation, leading to thermal noise. Currently, coatings of tantala and silica are annealed to decrease light absorption. However, annealing leads to crystallite formation in the coatings and, therefore, higher mechanical loss. Our experiment aims to reduce crystallization by using nanolayers of titania and silica. It's been shown that crystallite size is limited by layer thickness. We annealed samples containing titania nanolayers of varying thickness and have observed that thinner layers crystallize at higher temperatures, which is indicative of crystallite suppression. We hope to find the optimal thickness in which no crystallites are formed even at very high annealing temperatures.

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