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Multimodal Gentle Nodal Suspension Measurements of Zirconia-Titania Coatings

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Low thermal noise optical coatings are a key part of the design of current and future gravitational wave detectors. Coating thermal noise limits detector sensitivity in the mid range, about 50-300 Hz, where GW detectors are the most sensitive. Tetrahedral metal dioxides, such as silica (SiO2), have been shown to be the most promising materials for low loss amorphous coatings. We present mechanical loss results of zirconia-titania (ZrO2-TiO2) mixtures measured in a multimodal gentle nodal suspension. We demonstrate that high temperature annealing yields the lowest mechanical loss for these mixtures. We also present a method of multimodal data analysis that employs a digital lock-in amplifier to allow time-domain fitting of each mode ringdown. Zirconia-titania coatings are shown to be a promising high index of refraction material for gravitational wave detector optics.

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