

GWADW2022 - Approaching the low-frequency design sensitivity of ground-based detectors

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TiO₂:SiO₂ coating thermal noise and optical studies

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Current gravitational wave detectors are limited in their most sensitive frequency range by the mirror coating thermal noise which arises from the Brownian motion of the coating materials on the interferometer test mass optics. For the next generation detector upgrades and beyond, it is imperative to find coating materials/topologies that reduce this mechanical effect, whilst still meeting the desired optical requirements. Titania-doped silica had been identified as a coating material candidate which could potentially improve detector sensitivity.

We present here our investigations into the mechanical and optical properties of highly-reflective coating stacks made of pure SiO₂ and TiO₂ doped SiO₂, deposited via ion beam sputtering (IBS). Two different concentrations of TiO₂ doping in the high-refractive index layers of our coating stacks were investigated, with mechanical loss and optical absorption being measured through different steps of heat treatment for each, with the level of coating thermal noise being calculated from the former.

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