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New coating materials for thermal noise reduction in room temperature gravitational wave detectors

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New challenges in gravitational-wave astrophysics impose increasing sensitivity of current interferometric detectors operating at room temperature as Advanced LIGO and Advanced Virgo. Limits at their most sensitive frequency region arise from the Brownian thermal noise of the highly-reflective coatings on the interferometer mirrors. Such coatings are composed of alternating layers of low- and high-refractive index materials.
For upcoming upgrades of gravitational-wave detectors, it is imperative to find coating materials which reduce the thermal noise, whilst still meeting the desired optical requirements such as high reflectivity and low optical absorption.
Titania-doped silica has been identified as a coating material candidate which could potentially improve detector sensitivity. Collaboration with Glasgow University, we conducted studies into the mechanical and optical properties of highly-reflective coating stacks made of pure silica and titania doped silica, deposited via ion beam sputtering. Different doping concentrations of titania in the high-refractive index layers of our coating stacks were studied, through different heat treatment steps. This poster summarizes the current status of titania-doped silica as an alternative high-refractive index material for gravitational-wave detectors.

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