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Studies of coating absorption for future detectors

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As improvements to the current gravitational wave detector network are implemented, and as new detectors are added to the network, any new mirror coating designs must overcome the twofold challenge of producing sufficiently lower thermal noise perfomance, as well as maintaining a low level of optical absorption. Here we present an update on our research into characterizing the room temperature optical absorption of different mirror coatings; including a novel design multimaterial coating stack containing SiO_2/Ta_2O_5/aSi films deposited via ion plated deosition, as well as our work measuring TiO_2 : GeO_2 coatings of various doping concentrations. Photothermal common path interferometry was used to measure the absorption of coatings in their as deposited state, and through various stages of heat treatment up to 600,$^O C$. The nuances of direct-to-temperature heat treatment versus progressive heat treatment through intermediate steps were also studied for the multimaterial coating design, with some interesting results being obtained, seemingly showing a significant reduction in the performance of Ta_2O_5 layers at 2000,nm in response to the progressive anneal.

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