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Development of mixed oxide coatings for future detectors

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Future gravitational-wave observatories will require larger area mirror coatings with reduced thermal noise, absorption loss and scattering loss. The development of germanium dioxide mixed with titanium dioxide (TiO_2:GeO_2) for A+ LIGO has highlighted the need for additional R&D to address specific challenges of mixed oxide coatings.

We will present an overview of the development of mixed oxide coatings by ion beam sputtering. While cation ratio affects the material properties like refractive index and mechanical loss, other factors such as process base pressure and chamber geometry also play a significant role. We will discuss inclusions and blisters, and strategies for mitigation. Annealing protocols designed to reduce thermal noise will also be reviewed based on results from TiO_2:GeO_2 / SiO_2 stacks. Finally, we will describe the progress and plans for deposition of large area coatings (up to 62 cm diameter) at the Extreme Performance in Optical Coatings laboratory.

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