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Implanted Oxygen Ions in Silicon and the Implication for Future Gravitational Wave Mirrors

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While gravitational waves are regularly detected in several gravitational wave detectors globally, the research endeavors to improve the sensitivity of these detectors continues. Low mechanical loss and low optical absorption are key requirements of future coatings. Amorphous silicon has very low loss but relatively high absorption at the relevant wavelengths. Crystalline silicon also has low loss, but with lower absorption. Here we explore the use of ion implantation of oxygen ions into a silicon substrate to create a pattern of silica and crystalline silicon layers just below the surface. We present studies of the mechanical loss arising from a silica layer implanted approximately 100nm below the silicon surface.

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