

CO₂ POLISHING MACHINE OF THE BARREL SURFACE IN SiO₂ DISCS: FIRST TESTS AND CORRELATION WITH MECHANICAL AND MORPHOLOGICAL MEASUREMENTS

Brownian coating thermal noise is a limiting noise in advanced GW detectors at mid-range frequency and it is due to structural dissipation inside the material. The measurement of the coating loss angle requires substrates to be stable with respect to their dissipative behaviour. Particularly, silica discs are subject to ageing, compromising the accuracy of mechanical characterizations. It has been shown that, in commercial samples, the source of this deterioration is related to the ground, unpolished lateral surface. The effect of spurious losses can be quantified from the amount of loss angle separation in branches for different classes of resonating modes, since different mode shapes store different amount of elastic energy in this barrel surface. We have designed and assembled a facility for the thermal annealing of the barrel of commercial samples, to provide fast and reliable heat treatments reducing spurious losses to a negligible level: the heating power is provided by a high power CO₂ laser beam, delivered to the barrel surface by suitable optics and Galvo mirrors, to obtain an optimally shaped intensity profile that fits with the particular barrel thickness; the sample is housed by a rotating support, allowing the annealed region to be moved along the edge at a stable and controlled rate. Preliminary tests have already been performed. Morphological characterization, through atomic force microscope, and mechanical characterization, through GeNS ϕ measurements, are shown.

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