OPTICAL PROPERTIES OF AMORPHOUS SIO_2-TIO_2 MULTI-NANOLAYERED COATINGS FOR 1064-NM MIRROR TECHNOLOGY

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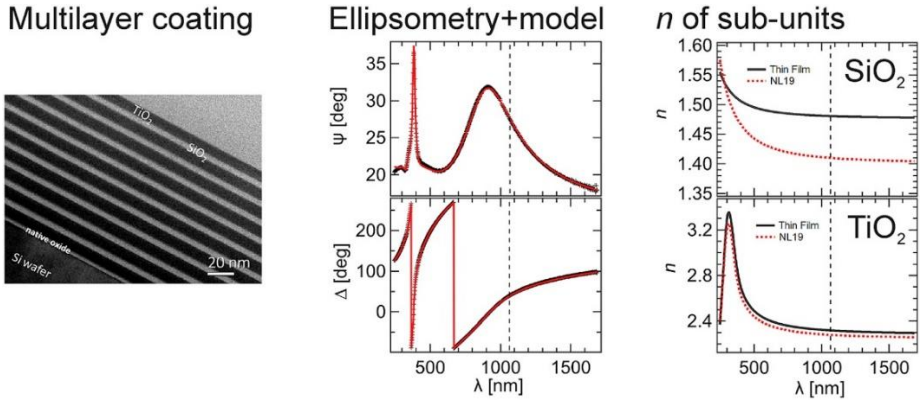

The use of amorphous, SiO_2-TiO_2 nanolayered coatings has been proposed recently for the mirrors of 3rd generation interferometric detectors of gravitational waves, to be operated at low temperature. The optimization of mirror designs based on such coatings requires a detailed knowledge of the optical properties of sub-units at the nm-thick scale. To this aim we have performed a Spectroscopic Ellipsometry (SE) study of amorphous SiO_2-TiO_2 nanolayered films deposited on Si wafers by Ion Beam Sputtering. We have analyzed films that are composed of 5 and 19 nanolayers (NL5 and NL19 samples) and have total optical thickness nominally equivalent to a quarter of wavelength at 1064 nm. By flanking SE with ancillary techniques, such as TEM and AFM, we built optical models that allowed us to retrieve the broadband (250-1700 nm) optical properties of the nanolayers in the NL5 and NL19 composite films [1]. Regarding the NL5 sample, with thickness of 19.9 nm and 27.1 nm for SiO_2 and TiO_2 sub-units, respectively, the optical properties presented limited variations with respect to the thin film counterparts. For the NL19 sample, which is composed of ultrathin sub-units (4.4 nm and 8.4 nm for SiO_2 and TiO_2, respectively) we observed a significant decrease of the IR refraction index for both types of subunits; this points to a lesser mass density with respect to the thin film reference.

[1] M. Magnozzi et al., Optical Mat., 75, 2018

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