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Characterization of Sputtered Amorphous GaN Film for High-Reflectivity and Low Loss Coatings

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The anelastic behavior of amorphous materials is explained by the presence of two level systems, metastable states that are separated by an energy barrier.

Not all the TLS contribute to the mechanical losses. The ones that are active are only those with a relaxation time comparable to the period T of the strain wave propagating in the material. In order to reduce the dissipation in the material a reduction of the total density of TLS is needed. Amorphous films whose constitutive atoms possess a coordination number larger than 3 should be characterized by a low amount of TLS. Indeed, if this atom is linked to at least four atoms not on the same plane, the structure is more rigid and TLS are unlikely, making structural reorganization more difficult.

Sputtered amorphous GaN has been taken into account as a good candidate for high refractive index material for future gravitational wave mirrors. Preliminary study on deposition parameters and their effects on optical, structural and morphological properties has been conducted. Good level of amorphousness has been reached using low deposition rate and high pressure. But optical absorption at 1064 nm, estimated by ellipsometric measurements, is still high with respect to GW detector requirements.

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