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The crystallization process in Ta2O5 and TiO2-Ta2O5 amorphous films

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In the current development of optical coatings for high precision instruments like GW interferometers thermal Brownian noise currently pose a limiting factor on the performances obtainable. In particular in the VIRGO experiment, in the 50-300 Hz region, thermal brownian noise act as the dominant contribution.
Since the Brownian noise is commonly attributed to the existence of many local energy minima in the atomic configuration a non-dissipative system like a crystal is expected to improve the mechanical response of the system. For this reason it is thought that the controlled formation of nanocrystallites inside the amorphous coatings could reduce the Brownian noise. The crystallite size and density must however be precisely controlled in order to find a trade-off between the
improvement of the mechanical properties and the formation of light scattering centers.
In this work we studied the crystallization kinetics of Ta2O5 and Ti:Ta2O5 by analyzing the evolution respect to time and temperature of the XRD spectra of our samples obtained treating them either in situ or via rapid thermal annealing. Due to some uncertainity from literature on the Ta2O5 low temperature crystalline phase the kinetics data are also complemented by Raman measurements and ab initio simulations to tackle the problem.

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