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Influence of sputtering pressure on the nanostructure and the X-ray reflectivity of iridium coatings

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Abstract

Reflective mirror coatings made of iridium are used in X-ray telescopes of the Chandra X-ray Observatory (CXO) launched in 1999 by the National Aeronautics and Space Administration (NASA) to investigate astronomical sources at photon energies below 10 keV. These coatings were produced in a DC magnetron sputtering process and have so far proven their suitability for space-based applications. We are in the present paper the processing of thin iridium films for lightweight telescopes using the radio frequency magnetron sputtering technique with an oblique angle deposition. The coating development presented here is focused on the influence of total sputtering pressure on film properties as well as on its impact on the mirror's performance. Characterisation methods such as X-ray diffractometry, X-ray reflectometry, atomic force microscopy and transmission electron microscopy have been used. Correlations between morphology, density, surface micro-roughness, crystal structure of the iridium layer and the expected reflectivity of the X-ray mirror are described and discussed.

Keywords: iridium thin film; radio-frequency magnetron sputtering; nanostructure; density; surface micro-roughness; X-ray reflectivity

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