Preparation and characterization of magnetron-sputtered single layers of Ta

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X-ray optical elements are required for beam transport at the upcoming advanced research light sources such as free-electron lasers and synchrotron sources. An x-ray mirror is a combination of a well-polished substrate and a suitable coating according to the application [1]. The demand for large mirrors (e.g. 1 m) with single layers consisting of light or heavy elements has increased during the last decade, since surface finishing technology is able to process longer mirror lengths on the sub-nanometer level [2]. Additionally, thin-film fabrication is able to deposit some tens of nanometers of a suitable single layer material over large areas [3]. After deposition, the mirror should provide excellent x-ray optical properties with respect to suitable thickness, low roughness values and slope errors. Then it is expected that the mirror will transport the x-ray beam with high reflectivity, high beam flux and undistorted wavefront to the experimental stations.

In this article we will present some experimental results of single layers of tantalum with a thickness of about 30 nm fabricated with the HZG sputtering facility. The achievable mirror dimensions are up to 1500 mm in length and about 120 mm in width. These coatings were investigated by means of x-ray reflectometry (XRR), stylus profilometry and interference microscopy. The achieved results are discussed according to thickness uniformity, density, and micro-roughness.

[1] VDI/VDE guideline 5575, part 4, (2011).
[2] H. Sinn, J. Gaudin, L. Samylova, A. Trapp and G. Galasso, CDR: X-Ray Optics and Beam Transport (XFEL.EU TR-2011-002).
[3] M. Störmer, F. Siewert, J. Gaudin, Proc. SPIE **8078**, 80780G-1 (2011).

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