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Reactive sputter magnetron reactor for preparation of thin films and simultaneous in-situ structural study by X-ray diffraction

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Reactive Sputter Magnetron (RSM) is a widely used technique to thin films growing of compounds both, in research laboratories and in industrial processes. The nature of the deposited compound will depend then on the nature of the magnetron target and the nature of the ions generated in the plasma. One important aspect of the problem is the knowledge of the evolution of the film during the process of growing itself. In this work, we present the design, construction of a chamber to be installed in the Huber goniometer in the XRD2 line of LNLS in Campinas, which allows in situ growing kinetic studies of thin films.

The purpose of the designed reactor is (i) to obtain polycrystalline and/or amorphous thin films by controlled deposition induced by a reactive sputtering magnetron and (ii) to perform a parallel in situ structural study of the deposited thin films by X-ray diffraction, in real time, during the whole growth process. The designed reactor allows for the control and precise variation of the relevant processing parameters, namely magnetron target-to-sample distance, DC magnetron voltage, nature of the gas mixture, gas pressure and temperature of the substrate. On the other hand, the chamber can be used in different X-ray diffraction scanning modes, namely $\theta - 2\theta$ scanning, fixed $\alpha - 2\theta$ scanning and also low angle techniques such as grazing incidence small angle X-ray scattering and X-ray reflectivity. The chamber was mounted on a standard four circle diffractometer located in a synchrotron beam line and firstly used for a preliminary X-ray diffraction analysis of AlN thin films during their growth on the surface of a (100) silicon wafer.

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