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Investigation of the porous structure of oblique angle deposited thin films with tailored architectures

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Oblique angle deposited (OAD) thin films offer many possibilities for tailoring their microstructure for specific applications, which are typically linked with the high fraction of void space and porosity available in these thin films (typically of 50% or more from the total volume of the films) and the possibility of tailoring their microstructure in the form of slanted, chiral, zig-zag or similar nanostructures [1]. Combining these films in the form of multilayers of different materials open additional ways for tailoring their microstructure and the development of new properties for advanced applications [2], e.g., optofluidic sensors, fuel cells and many others. For all these applications, control of the porous structures is essential and a precise knowledge is required of the porous structure, the interconnection between open pores, the possibility of creating close pores, etc.

Here, we will present the first results for the investigation of three different nano-columnar systems: single element (i) SiO_2 (Fig. 1) and (ii) TiO_2 films, and (iii) SiO_2/TiO_2 multilayers, which have been studied by means of Doppler broadening (DB) and positron annihilation lifetime spectroscopy (PALS) using the MePS facility at HZDR. *Three* different pore populations have been detected for SiO_2 nano-columns, *two* for multilayers and only *one* pore size for TiO_2. Pore size distribution evaluated by the MELT code will be given.

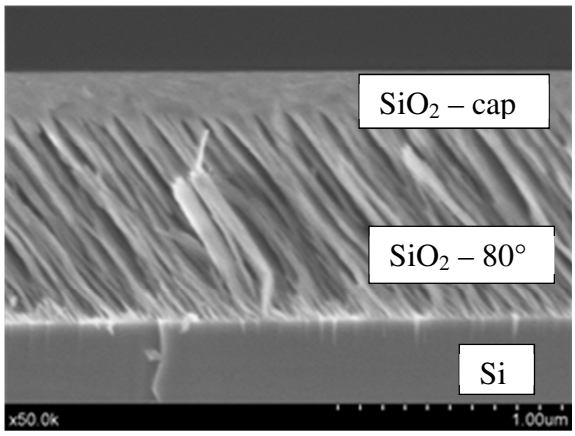

Fig. 1 Cross-sectional SEM image of e-beam evaporated SiO2 nano-columnar film (about 1 µm thick), capped with about 200 nm thick compact SiO_2 layer.

[1] A. Barranco *et al.*, *Mater. Sci.* **76** 59 (2016)
[2] M. Oliva-Ramirez *et al.*, *ACS Nano* **10**, 1256 (2016) DOI: 10.1021/acsnano.5b06625