

Characterization of Ordered Arrays of Topological Defects in Mesoporous Silica Films.

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Hexagonal phase mesoporous silica films were grown in a shear flow field on a mica substrate with channels dominantly orientated parallel to the substrate basal plane. We found that ordered arrays of topological defects lead to mesoporous silica films with long-range orientation and rotational order. About half of these epitaxial films form with their channels normal to the substrate. Two-dimensional X-ray patterns recorded from films grown on mica are "single-crystal-like" exhibiting 6-fold symmetry that is rotationally invariant over the entire film. X-ray diffraction patterns were collected in transmission geometry with the beam perpendicular to the substrate using the Mar345 image plate detector. The camera length, beam diameter, and the wavelength were 425mm, 0.5mm and 1.5659 respectively.

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References: H.W. Hillhouse, J.W. vanEgmond, M. Tsapatsis, J.C. Hanson and J.Z. Larese Chem. Mat., **12**, 2888-2893 (2000).

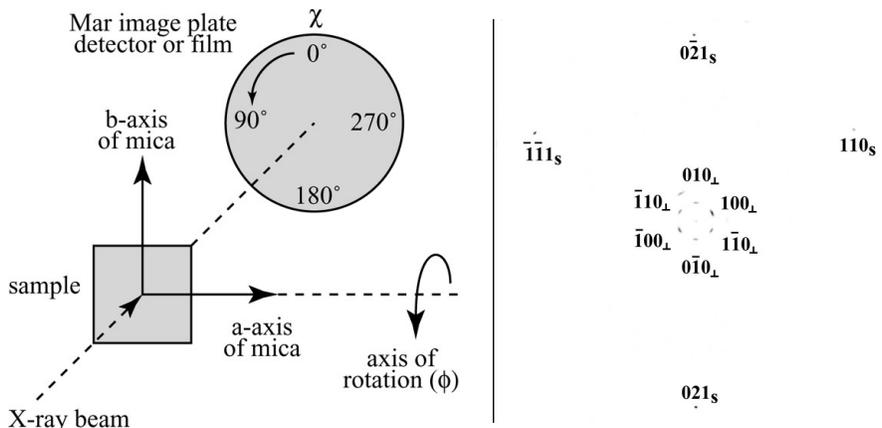


Figure 1. (left). Experimental setup. (right) Two-dimensional transmission X-ray diffraction pattern showing epitaxial growth of the hexagonal mesophase on a muscovite substrate. The diffraction peaks from the substrate are indexed with the $2M_1$ polytype and are labeled as hkl_s . The lower angle scattering is from the mesophase and the peaks are indexed in plane group $p6mm$ from a perpendicularly orientated phase.

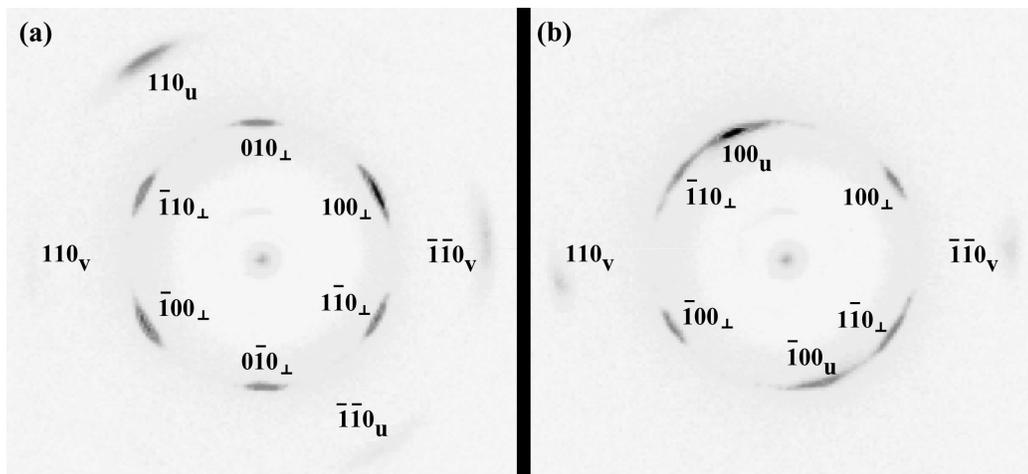


Figure 2. Two-dimensional X-ray diffraction patterns of sample rotated about ϕ axis. a. Enlarged view of Figure 1 ($\phi = 0^\circ$). Six inner reflections are from 6-fold symmetric mesophase (d-spacing 42.4Å) perpendicular to the substrate. The weaker peaks may be indexed to regions in the mesophase oriented with peaks parallel to the substrate (subscripted u and v). b. Diffraction pattern $\phi = 30^\circ$ orientation shows reflections perpendicular and parallel to the substrate.