# In situ study of the synthesis of lamellar metal chalcogenides by alternating deposition of organic & inorganic molecules

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Lamellar Metal Dichalcogenides have emerged as a class of exceptional materials which exhibits remarkable electronic and chemical properties on the scale of a few monolayers. In the quest for large-scale deposition methods for the fabrication of ultra-thin films of textured lamellar metal chalcogenides on amorphous substrate, we have adopted a synthesis strategy based on the alternating deposition of a metal precursor molecule with an organic precursor molecule followed by a specific annealing and applied it to the preparation of titanium disulfide (TiS2) [1-3]. The fine control of the whole synthesis process could be achieved by in situ synchrotron and ellipsometry studies during the 2-step process (Fig. 1a,b) using a custom-built portable reactor which mounts onto the 6-axis tower of the NewportTM diffractometer installed at the beamline SIRIUS (Fig. 1c), a thorough ex situ structural and chemical characterizations, and chemical experimental modeling on high surface area silica beads. Deeper understanding of the bonding mechanism at the early stage of growth could be obtained by quantitative analysis of x-ray absorption spectra recorded in situ during the growth at both the Ti and S K-edges, exploiting the results from density functional theory calculations [4].

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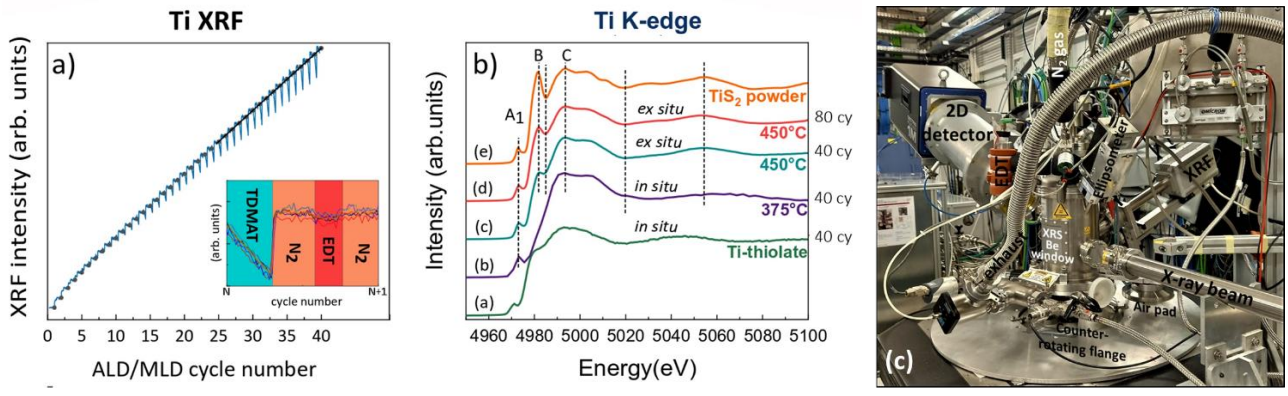


Fig. 1 (a) Chemical vapor deposition (hybrid Atomic Layer Deposition/Molecular Layer Deposition) reactor built for surface-sensitive in situ synchrotron studies, installed at synchrotron SOLEIL (Saint Aubin, France), (b) Ti x-ray fluorescence emission intensity and (c) Ti K-edge x-ray absorption spectra

References

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