Controlled 2D TMD layer growth at industrial platform

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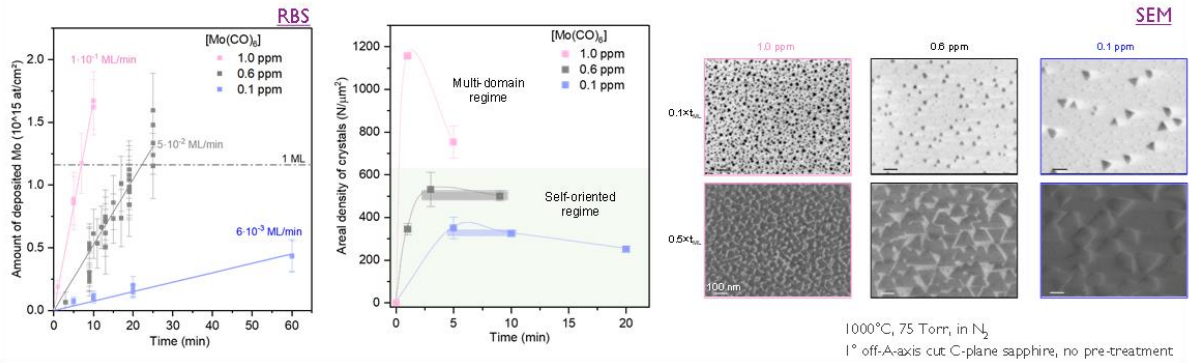
Two-dimensional (2D) transition metal dichalcogenide (TMD) materials hold significant promise for next-generation logic devices, while their integration into fabrication (FAB) processes requires precise control during growth, high performance, and scalable defect identification. However, the literature indicates that large-area single-crystal growth has thus far been conducted with non-FAB compatible chemistries, such as selecting metal-oxide precursors or employing catalyst-assisted (mostly alkali metal) metal-organic chemical vapour deposition (MOCVD) processes[1, 2]. Alongside MOCVD growth, there remains a lack of understanding regarding the chemical reactions involved in the growth of wafer-scale single-crystal monolayers.

In this talk, I will briefly introduce the FAB-adapted industrial MOCVD process to develop 2D MX2 layer growth. I will highlight (with governed understanding) the basic needs, factors affecting the epitaxy and mechanisms involved to achieve fully closed monolayer single-domain MX2 layer growth at 200mm platform. A chemical understanding and outcome of the growth processes will also be highlighted, including the role of reactant species with intermediate stage analysis and formation.



Figures: Highlighted growth rate dependence and control over the nuclei density, which define the orientation of the closed monolayer TMD layer.