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Synthesis of two-dimensional materials via liquid metal catalysts route: Instrument development for *in situ* investigation

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Two-dimensional materials (2DMs) hold great promise for future applications in many technological areas. However, the main hurdle against practical utilization of 2DMs is the lack of effective mass production techniques to satisfy the growing qualitative and quantitative demands for scientific and technological applications. The current state-of-the-art synthesis method of 2DMs involves the dissociative adsorption of gas-phase precursors on a solid catalyst. This process is slow by nature, inefficient, and environmentally unfriendly. Our analysis and recent experimental evidence suggest that using liquid metal catalysts (LMCats) instead of solid ones bears the prospect of a continuous production of 2DMs with unprecedented quality and production speed. However, the current knowledge about the catalytic properties of LMCats is extremely poor, as they had no technological significance in the past. In fact, there exist no well-established experimental facilities, nor theoretical frameworks to study the ongoing chemical reactions on a molten surface at elevated temperatures and under a reactive gas atmosphere. Our aim is to establish a central lab at the ESRF in Grenoble, under supervision of several scientific/engineering teams across Europe to develop instrumentation capable of studying the ongoing chemical reactions on the molten catalyst, with the goal to open two new lines of research, namely *in situ* investigations on the catalytic activity of LMCats in general, and unraveling the growth mechanisms of 2DMs on LMCat surfaces in specific. Gaining this knowledge would be the key toward establishing the first efficient mass production method for 2DMs using the new LMCat technology.

Biography

Amirmehdi Saedi has completed his PhD at the University of Twente (Physics of Interfaces and Nanostructures). He is currently Postdoctoral Fellow at the Leiden Institute of Chemistry (Catalysis and Surface Chemistry) in the Netherlands. His research background covers a diverse collection of topics within Surface Science, including Electrochemistry, Nano-Materials, Thin Film Growth, and Catalysis.

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