WWU MÜNSTER

Aktuelle Fragen der Nanophysik

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Advances in room temperature liquid metal chemistry towards nanomaterial synthesis, electronic devices and catalysis

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Room temperature liquid metals are a class of unique materials that have been left largely unexplored by the wider scientific community.(1) We have recently demonstrated that these liquid alloys are ideally suited to serve as the reaction solvent for the synthesis of large area, atomically thin materials.(2-4) The process utilizes the formation of atomically thin surface oxides that can be exfoliated from the liquid metal.(1) Interestingly, the unique properties of the liquid metal interface allow isolating 2D morphologies of non-stratified materials, which are otherwise difficult to obtain.(2)

This talk will expand on our previous reports and discuss our ongoing work on a wide variety of ultrathin 2D materials including piezoelectric nanosheets (i.e. 2D $GaPO_4$ and 2D SnS), 2D transparent conductive oxides (ITO and GZO) and 2D wide bandgap semiconductors (i.e. Bi_2O_3 and GaN). The wide variety of accessible materials renders the use of liquid metal-based processes to be a promising approach towards low cost, high performance printed and flexible electronics.

Other applications of liquid metals that will be discussed include liquid metal-based synthesis approaches towards high surface area nanoplatelet and nanorod based aerogels and the creation of highly active liquid metal-based CO_2 reduction catalysts.

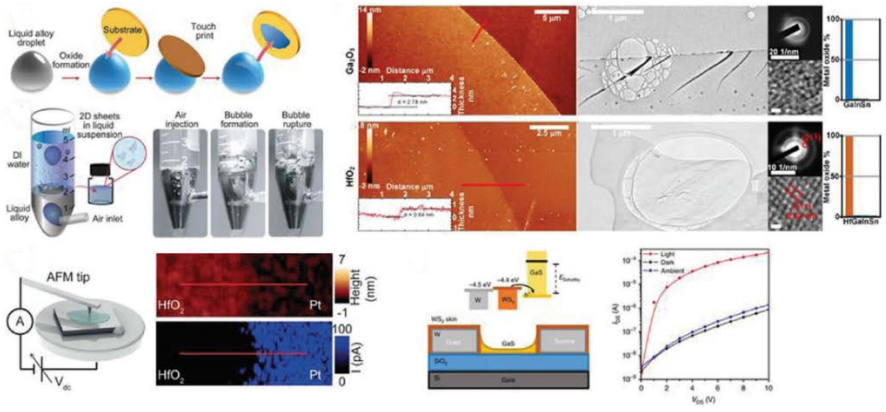

Fig. 1. Overview of liquid metal synthesis approaches, AFM and TEM characterizations of isolated sheets and evaluation of their electronic properties.

1. T. Daeneke *et al.*, Liquid metals: fundamentals and applications in chemistry. *Chem. Soc. Rev.* **47**, 4073-4111 (2018).
2. A. Zavabeti *et al.*, A liquid metal reaction environment for the room-temperature synthesis of atomically thin metal oxides. *Science* **358**, 332-335 (2017).
3. B. J. Carey *et al.*, Wafer Scale Two Dimensional Semiconductors from Printed Oxide Skin of Liquid Metals *Nat. Commun.* **8**, 14482 (2017).
4.T. Daeneke *et al.*, Wafer-Scale Synthesis of Semiconducting SnO Monolayers from Interfacial Oxide Layers of Metallic Liquid Tin. *ACS Nano*, 10974-10983 (2017).