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Rational Designing of Vapor-liquid-solid Oxide Nanowire Growth

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Metal oxide nanowires formed via vapor-liquid-solid (VLS) method hold great promise for various nanoscale device applications due to their fascinating physical properties, which are hardly attainable to other materials. However, the material range of VLS grown oxide nanowires has been substantially limited due to the lack of a design strategy for oxide VLS. Here we propose a rational concept to design a VLS grown metal oxide nanowire based on so-called “flux window principle”. The flux window principle has been theoretically proposed by us as the intrinsic mechanism of VLS, which predicts an emergence of VLS nanowires within a limited material flux range, where a nucleation preferentially occurs only at a liquid-solid interface. We show that the trend of material flux windows for conventional VLS oxide nanowires, including ZnO, SnO_2, In_2O_3 and MgO, well conforms to theoretical prediction via molecular dynamic simulation. Furthermore, based on the present flux window principle, we successfully create novel oxide VLS single crystalline nanowires, including MnO, SrO, CaO, Sm_2O_3, NiO and Eu_2O_3, which had been impossible to form via VLS route. Thus this proposed concept based on a flux window principle offers a useful guideline to design and discover novel VLS nanowires composed of functional oxide materials.

References

[1] Paper in submission

[2] J. Am. Chem. Soc. 135, 7033 (2013)

[3] J. Phys. Chem. C 117, 1197 (2013)

[4] J. Phys. Chem. C 116, 24367 (2013)

[5] Appl. Phys. Lett. 97, 073114 (2010)