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Symposium NM03: Progress in Developing and Applications of Functional One-Dimensional Nanostructures

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11:00 AM - NM03.01.07
Low Temperature Synthesis of Germanium Nanorods and Nanowires

Sven Barth [1], Patrik Pertl [1], Michael Seifner [1], Alois Lugstein [2]
[1] Institute of Materials Chemistry, Vienna University of Technology, Vienna Austria, [2] Institute of Solid State Electronics, Vienna University of Technology, Vienna Austria

Hide Abstract

Germanium nanowires and nanorods have a broad spectrum of potential applications including electronic devices, lithium ion batteries, sensors *etc*. However, the synthesis of these anisotropic nanostructures usually requires temperatures >300 °C hampering the growth on temperature-sensitive materials such as polymers.
We present in this contribution the growth of highly crystalline Ge nanowires and nanorods at temperatures as low as 170 °C. These structures grow either via the solution-liquid-solid (SLS) or the vapor-liquid-solid (VLS) mechanism depending on the growth conditions. In addition, we can show that the slow growth of these structures at low temperatures is due to the precursor decomposition characteristics as a limiting factor. Moreover, the decomposition of the Ge precursor is catalyzed by the presence of Ga seeds. Ge nanowires have been characterized by different analytical methods including TEM, EDX as well as XRD and the incorporation of unusually high Ga contents of up to 3% in the Ge structures has been observed. Unusually high metal incorporation in group IV nanowires has been observed for other semiconductor/metal combinations [1] and helped targeting metastable compositions [2]. Therefore, electrical characterization of individual Ge nanowires has been performed in order to quantify the impact of the Ga incorporation on their conductivity.[3] According to the phase diagram, Ga has excellent potential for the Ge nanowire formation at even lower temperatures using suitable Ge precursors, which will be targeted in future studies.

[1] O. Moutanabbir, D. Insheim, et.al. *Nature* 2013, *496*, 78.
[2] M. S. Seifner, F. Biegger, A. Lugstein, J. Bernardi, S. Barth *Chem. Mater.* 2015, *27*, 6125.
[3] P. Pertl, M. S. Seifner, A. Lugstein, S. Barth *submitted*.

11:15 AM - NM03.01.08