CT34

Synthesis and Characterization of Ultra-Long Boron Nanowires with Chemical Vapor Deposition Method

Fatma Nur Tuzluca[a,d*], Yasar Ozkan Yesilbag[a,d], Burak Sahin[a] and Mehmet Ertugrul[b,c,d]

[a] *Department of Physics, Erzincan University, Erzincan 24100, Turkey*
[b] *Department of Electrical and Electronics Engineering, Ataturk University, Erzurum 25240, Turkey*
[c] *Department of Nanoscience and Nanoengineering, Ataturk University, Erzurum 25240, Turkey*
[d] *Nanoscience and Nanoengineering Application and Research Center, Ataturk University, Erzurum 25240, Turkey*

[*]Corresponding author
E-mail address: ftuzluca@erzincan.edu.tr
Phone: +90-446-2243032, Fax: +90-446-2243016

[keywords] Boron nanowires, CVD, VLS.

Among well-known light elements such as Boron, Carbon and Nitrogen, boron possesses many unique properties. Similarly to carbon and silicon, boron shows an obvious tendency to form covalent molecular compounds, but differs dramatically from carbon in having one less valence electron than the number of valence orbitals. [1]. Boron and it's compounds are semiconductors with electronic properties controlled by icosahedron structures. Since boron and it's compounds are suitable for a variety of applications including high temperature (light) coatings and semiconductor electronic devices, these properties make them attractive in fields such as nanoelectronics, nanophotonics and nanobiosensors [2]. Electrical conductivity of the thin film and bulk form of Boron is low [3], because the band gap of these structures is in semiconductor form. Boron nanowires, like metals, have high electrical conductivity [4] and mechanical strength [5]. Recent interest in boron and one-dimensional (1D) boron nanowires has increased considerably due to their potential applications in nanodevices.

In this study performed using a chemical vapor deposition (CVD) system, 1D boron nanowires were investigated. These nanowires were grown via Vapor–Liquid–Solid (VLS) mechanism according to growth time differences (90, 120 and 180 min.). Structure, morphology and elemental analysis of the boron nanowires were carried out using the X-ray diffractometer technique (PANalytical Empyrean, Cu-Kα, λ=1.54060 Å), a micro raman (WITec alpha300R, λ=532 nm, optical power 30 mW), a X-ray photoelectron spectra (SPECS-Flex, Al-Kα), a field-emission scanning electron microscope (FESEM: FEI Quanta 450 FEG) and an EDS analyzer in the FESEM system (EDAX, AMETEK Materials Analysis Division) respectively.

*This research is partially supported by Erzincan University (Scientific Research Project Unit) project number FBA-2017-468.

References

[1] V. I. Matkovich et al, Boron and Refractory Borides (1977).
[2] Z. Li et al, Applied Physics Letters **92**, 3-5 (2008).
[3] J. A. Kohn et al, Boron Synthesis, Structure, and Properties (1960).
[4] L. Ge et al, Nanotechnology, **25**, 335701 (2014).
[5] J. Tian et al, AIP Conference Proceedings **1173**, 317-323 (2009).