engineering proceedings

Abstract

Precise Layer Separation of Two-Dimensional Nanomaterials for Scalable Optoelectronics †

Joohoon Kang

School of Advanced Materials Science and Engineering, Sungkyunkwan University (SKKU), Suwon 16419, South Korea; joohoon@skku.edu

† Presented at the 1st International Conference on Micromachines and Applications, 15–30 April 2021; Available online: https://sciforum.net/conference/Micromachines2021.

Abstract: The biggest challenge in the field of low-dimensional nanomaterials, in terms of practical application, is scalable production with structural uniformity. As the size of materials is becoming smaller, the tendency of their structure-dependent properties, which directly affects the device reliability of largescale applications, is to become stronger due to quantum confinement effects. For example, one-dimensional (1D) carbon nanotubes have various electrical/optical properties based on their structures (e.g., diameter, chirality, etc.). Likewise, two-dimensional (2D) layered materials also exhibit different properties based on their thickness. To overcome such structural heterogeneity, isopycnic density gradient ultracentrifugation (i-DGU) will be introduced to achieve monodispersity of nanomaterials in structure based on their buoyant density differentiations. The i-DGU approach makes it possible to sort 1D carbon nanotubes and 2D layered materials such as graphene, transition metal dichalcogenides and hexagonal boron nitride with high structural purity, based on their structure. Various largescale optoelectronic applications, electrically driven light emitters and photodetectors demonstrated based on the monodisperse nanomaterials will be discussed.

Keywords: 2D materials; layer sorting; solution processing; density gradient ultracentrifugation

Citation: Kang, J. Precise Layer Separation of Two-Dimensional Nanomaterials for Scalable Optoelectronics. *Eng. Proc.* **2021**, *4*, 5. https://doi.org/10.3390/Micromachines2021-09553

Academic Editor: Ion Stiharu

Published: 14 April 2021

Supplementary Materials: The following are available online at www.mdpi.com/10.3390/Micromachines2021-09553/s1.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.