Synthesis of wafer-scale 2-dimensional metal chalcogenide films

Changgu Lee\textsuperscript{1,2}

\textsuperscript{1} SKKU Advanced Institute of Nano Technology(SAINT), Sungkyunkwan University, Suwon, Kyunggi-do 440-746, South Korea

\textsuperscript{2} School of Mechanical Engineering, Sungkyunkwan University, Suwon, Kyunggi-do 440-746, South Korea

E-mail address: peterlee@skku.edu

In this talk, I will present synthesis methods of large area 2-dimensional materials. For the synthesis of large area and uniform thin films of MoS\textsubscript{2}, we used chemical vapor deposition with a gas precursor, H\textsubscript{2}S for sulfurization of Mo.[1] We deposited Mo metal first on solid substrates and sulfurized the metal at high temperatures. The synthesized MoS\textsubscript{2} films were almost perfectly uniform over the entire area of 2 inch wafer. We also synthesized MoS\textsubscript{2} films with MoO\textsubscript{3} and H\textsubscript{2}S for high quality films.[2] We could synthesize MoS\textsubscript{2} films up to 15cm with high uniformity and excellent electrical properties. In order to lower the synthesis temperature, we adopted plasma enhanced CVD method.[3] Down to 150\textdegree C, we could synthesize uniform films of MoS\textsubscript{2} directly on a plastic substrate (polyimide). ReS\textsubscript{2} could be synthesized on a flexible glass substrate at a low temperature directly due to the low evaporation temperature of the precursor. We also synthesized large area NbS\textsubscript{2} thin films as the transparent electrode for 2D metal chalcogenide semiconductor device. We characterized the various optical and electrical properties of the synthesized films.

References


Acknowledgements

This study was supported by an Institute for Information & Communications Technology Promotion (IITP) grant (B0117-16-1003, Fundamental technologies of two-dimensional materials and devices for the platform of new-functional smart devices), the Basic Science Research Program (2016R1A2B4012931) and the Global Frontier Research Center for Advanced Soft Electronics (2011–0031630) through a National Research Foundation of Korea grant funded by the Korean government Ministry of Science, ICT and Future Planning.