Different strategies for GaN-MoS_2 and GaN-WS_2 core–shell nanowire growth

Edgars Butanovs[1,2], Kevon Kadiwala[1]*, Aleksejs Gopejenko[1], Dmitry Bocharov[1], Sergei Piskunov[1], Boris Polyakov[1].
*lead presenter: kevon.kadiwala@cfi.lu.lv
1 Institute of Solid State Physics, University of Latvia, Kengaraga street 8, Riga, Latvia.
2 Institute of Technology, University of Tartu, Nooruse 1, Tartu, Estonia.

Nanowires (NWs), one-dimensional (1D) nanostructures, have desirable characteristics for use in various functional devices. By combining different materials, such as layered van der Waals and conventional semiconductors, into core-shell nanowire heterostructures, their properties can be improved or tailored for specific applications. This study shows the growth of GaN-MoS_2 and GaN-WS_2 core-shell NWs through two methods: (1) a two-step process involving sputter deposition of a transition metal oxide coating and sulfurization; (2) pulsed laser deposition of few-layer MoS_2 or WS_2 from material targets. The nanostructures were characterized using various techniques including electron microscopy, X-ray diffraction, Raman spectroscopy, and photoelectron spectroscopy. Both methods produced high-quality core-shell NW heterostructures. The results were supported by electronic structure calculations, showing the potential for these structures to be efficient photocatalysts for hydrogen production from water.