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Novel (EuIn)As/InAs(Sb) Nanowires Grown by MBE

EuIn_2As_2 is among a vast list of newly emerging Zentel compounds^{1,2}. This work focuses on growth and study of novel, (EuIn)As/InAsSb nanowires (NWs) produced by Au-assisted vapor liquid solid (VLS) molecular beam epitaxy (MBE). (EuIn)As shells were grown on three different core NWs: wurtzite (WZ) InAs, zinc blende (ZB) stalactite InAs NWs, and ZB $\text{InAs}_{0.9}\text{Sb}_{0.1}$ NWs. Molecular Dynamics simulations support the substantial difference between (EuIn)As shell formation on WZ and ZB, where the latter proves to be a significantly better host for Eu atoms. Morphology, structure and composition of the Eu containing NWs were studied using SEM, HR-TEM, HAADF-STEM and EDS. A unique ZB-like mosaic structure is typical of the (EuIn)As shell regardless of the core. We obtained particularly interesting information regarding the atomic coordination of the eight fold Eu situated between two As layers. Interestingly, Eu ions induce inversion domain boundaries (IDB), inducing a flip of the InAs lattice, similarly to what has been reported in bulk EuIn_2As_2 . The Eu atoms are situated along the three $\{111\}$ planes forming a prismatic structure³. The as grown NWs and unique crystal structure are seen in the images below. Low temperature SQUID magnetic measurements confirm that all nanowires show a magnetic signal though we cannot confirm whether they are paramagnetic, antiferromagnetic or noisy ferromagnetic. A small group was found to show a DC ferromagnetic signal. We are able to relate these results to the unique crystal structure and proceeding to growth of EuInAs ternary NWs.

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