

Supplementary Pages (Optional)

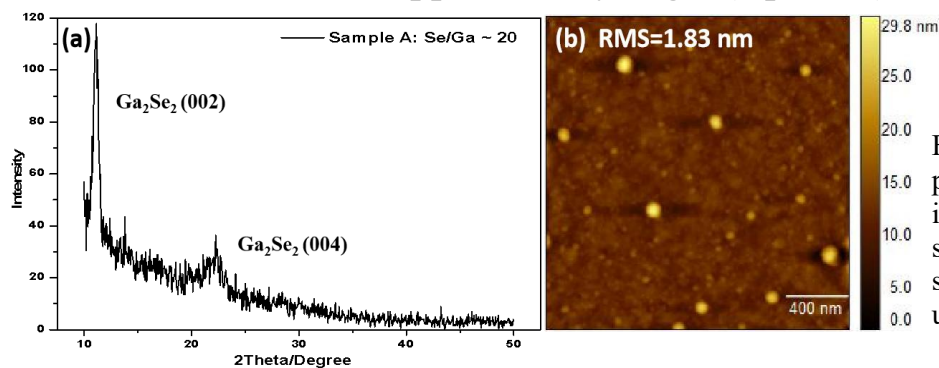


Fig. S1 (a) XRD pattern and (b) AFM image (2 μm *2 μm) of sample A grown on sapphire substrate using Se:Ga~20.

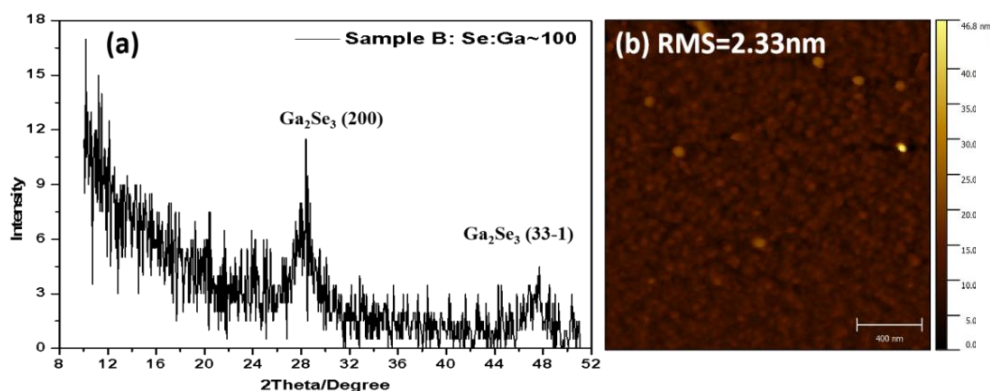


Fig. S2 (a) XRD pattern and (b) AFM image (2 μm *2 μm) of sample B grown on sapphire substrate using Se:Ga~100. Too much excess of Se causes Ga_2Se_3 instead of Ga_2Se_2 .

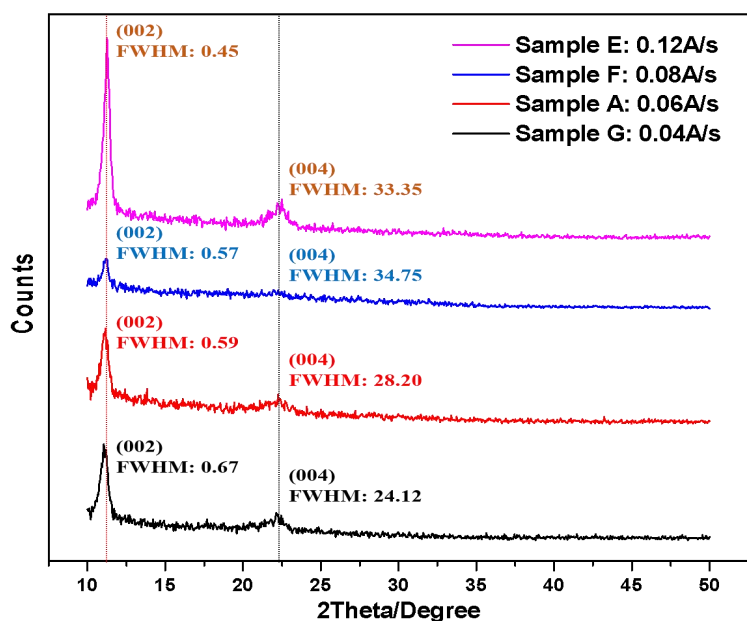


Fig. S3 XRD patterns for the comparison between different growth rates. Sample E, F, A, G were grown under same growth temperature and Se:Ga flux ratio, but used the growth rate of 0.12, 0.08, 0.06 and 0.04 $\text{\AA}/\text{s}$, respectively. Red and black dash lines indicate Ga_2Se_2 -(002) and (004) peaks, respectively. Full-width at half maximum (FWHM) value gives the degree of crystallinity.

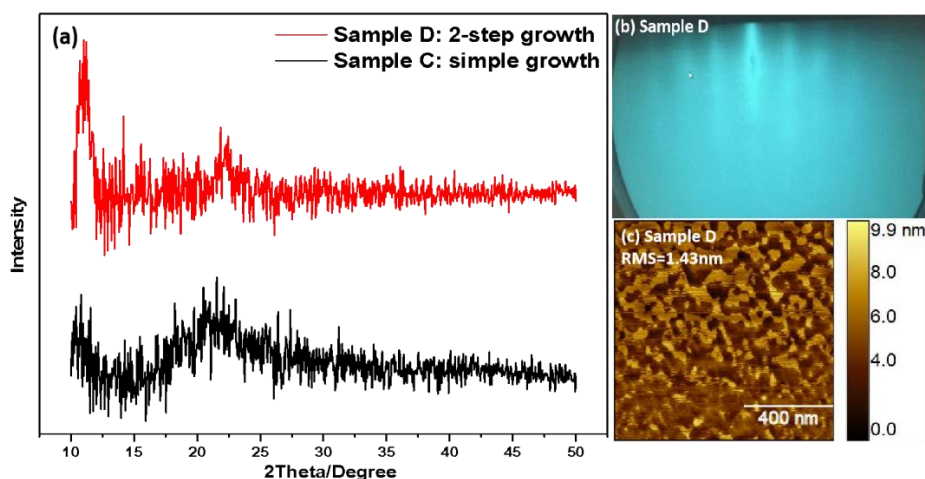


Fig. S4 (a) XRD patterns for sample C using simple growth mode, and sample D using 2-step growth mode, (b) in-situ RHEED pattern at the end of sample D growth, (c) AFM (1 μm *1 μm) for sample D.