Raman and XPS characterization of synthesized $PtSe_2$ thin films

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Platinumdiselenide ($PtSe_2$) is a layered noble metal dichalcogenide (NMD) with a number of remarkable properties. The bulk semimetal undergoes a transition to semiconductor with decreasing number of atomic layers. Few layered $PtSe_2$ possesses a band gap in the infrared region. Further, $PtSe_2$ can be synthesized at low temperatures and has proven to be relatively air stable, both prerequisites for most applications. Achieving a high film quality is crucial in order to maximize the performance of devices such as chemical sensors [1], IR-Photodetectors [2] or pressure sensors [3].
Here we present a detailed Raman and XPS characterization of grown $PtSe_2$ thin films. Wafer scale synthesis of $PtSe_2$ was achieved through selenization of pre-deposited platinum thin films by Thermally Assisted Conversion (TAC) using a custom designed reactor. The growth was carried out at temperatures between 400 °C and 600 °C on various substrates with selenium as a solid state precursor. Synthesis optimization shows a high dependence of the film quality on the process parameters. With carefully defined metrics for Raman and XPS measurements minor variations in quality and structural composition of the $PtSe_2$ films can be identified [4]. This precise quality assessment of $PtSe_2$ is a step forward in the development of 2D materials based hybrid devices.

References

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Figures

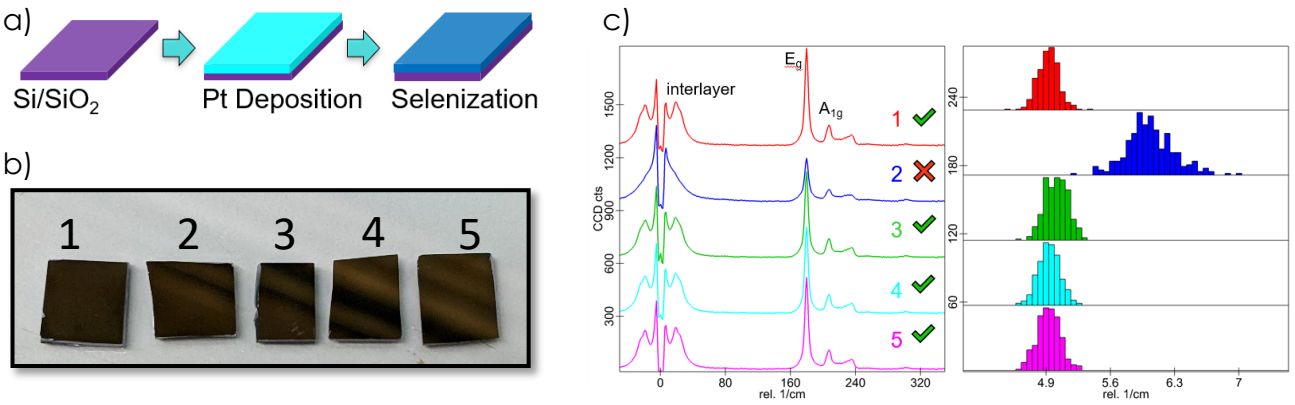

Figure 1: a) Direct selenization of pre-deposited Platinum layers. b) $PtSe_2$ thin films on SiO_2/Si. c) Raman spectra of the selenized $PtSe_2$ films. The varying quality of all successful converted films is evident in the statistical analysis of Raman mapping.