# $PtSe_2$: From Layer to Device

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The growing interest in 2D materials in recent years has intensified research into understanding their physicochemical properties and related systems. Among the transition metal dichalcogenides (TMDs) currently under intensive investigation is PtSe2, which exhibits a high theoretical value of charge carrier mobility and semiconducting properties in the single monolayer, and high surface chemical stability [1,2]. These features indicate significant potential for applications, including planar architecture devices based on PtSe2 layers. Furthermore, the energy band gap in the TMD depends on various factors, such as the number of PtSe2 monolayers, strain in the system, structural defects and doping [3,4]. The ability to band gap engineering, combined with the formation of effective electrical contacts, calls for a comprehensive analysis of the physicochemical properties of both PtSe2 and metal/PtSe2 systems.

This presentation will discuss in detail the properties of the PtSe2/Al2O3 systems, in terms of the TMD material thickness, determined using nonpolarized and polarized Raman spectroscopy (RS) measurements [5,6]. Further discussion will focus on the influence of the deposited metal layer on the physicochemical properties of the metal/PtSe2 system using spectroscopic (RS and XPS) and microscopic (SEM and AFM) techniques. These measurements will be presented both for the systems after metallic layer deposition and followed by thermal treatment at 500°C for 30 min. The discussion will conclude with the presentation of the 3L PtSe2-based transfer line measurement structure, fabricated using controlled argon plasma etching. The argon plasma etching method, combined with the RS measurements, allows for the precise analysis of the PtSe2 layer degradation dynamics [7].

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