Layered transition metal dichalcogenides (TMDs) have been researched intensively as materials for low power transistors. Strong spin orbit interactions combined with a direct bandgap in monolayers of MX$_2$ (M: Mo, W; X: S, Se) make them very attractive for spintronics and valleytronics. The realization of the promise offered by these materials depends on the ability to access their intrinsic properties, rather than measuring the effect of the environment.

In this work, we compare the electrical conductance of TMD field effect transistors with the structural properties of TMD films that were prepared in the same way. We study several combinations of channel materials (WSe$_2$ and MoS$_2$) and metals (Sc, Ti/Au, Pd) prepared using different techniques and measured under different conditions. We show clear correlations between the level of contamination of the films and their measured electrical characteristics. We discuss the effect of metal deposition on the compositions and properties of the TMD films. The results strongly suggest that the performance of TMD transistors is limited by the contamination of the channel material, as well as by interactions of metals with the TMD during metal deposition.