# Investigation of atomic-layered lateral-heterosturcture by SPEM

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## Abstract

Scanning photoelectron microscopy (SPEM) is a powerful technique for discover the physical and chemical properties of transition metal dichalcogenides (TMDs).[1][2] Atomic-scale thick of two-dimensional layered TMDs are promising as an active semiconductor channel for next-generation devices. To achieve ultimate performance and process various applications, locally controlled doping engineering for lateral-heterostructure of TMDs is desired to satisfy their physical and chemical properties in devices. Besides the doping engineering, due to the small dimension of TMDs flake (about 1~50um), few measurement techniques can locally characterize doping property of TMDs, most of them only proved large scale (~ 1mm) and average result. Here, we demonstrate the post- substitutional-doping strategy to conduct lateral-heterostructure of tungsten disulfide ($WS_2$). The localized Cr atom substitutional induced doping effect was confirmed by SPEM and μ-XPS. The Cr dopants exhibit an p-type doping behavior in the $WS_2$ layers based on the down shift of binding energy from μ-XPS measurements. For semiconductor, despite of earlier investigation which the dopant concentration will manipulate the fermi level, we experimentally discovered that the shift of binding energy remain the same for different concentration of Cr dopant. This result may give an interesting suggestion that the acceptor level/ donator level between valance/conduction band is independent of amount of dopant, but only correlate with species of dopant.

***Keywords – TMDs, lateral-heterostructure, ,SPEM, substitutional doping***

References

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