Investigating the Role of Metal Substrates in Large-Area Exfoliation of TMDCs

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Gold-assisted exfoliation has emerged as an effective technique for selectively obtaining large-area monolayers of transition metal dichalcogenides (TMDCs), yet its underlying mechanism is still a subject of debate [1,2]. While other metals can also facilitate exfoliation, their practical use is limited by oxidation of their surface [3].
In this study, we systematically investigate six MoS_2/metal heterostructures prepared via direct mechanical exfoliation onto metallic surfaces under controlled atmosphere conditions (Fig. 1a-f). Our results obtained through ultraviolet photoelectron spectroscopy, X-ray photoelectron spectroscopy, and Raman spectroscopy reveal significant variations in interfacial interactions depending on the metal choice. These results provide key insights into the impact of metal substrates on the electronic structure and vibrational properties of MoS_2. This interaction also leads to distinct Raman fingerprints (Fig. 1g), offering a more comprehensive explanation for the observed spectral changes when MoS_2 is in contact with different metals. Furthermore, our findings provide fundamental insights into the mechanisms driving metal-assisted exfoliation.

References

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Figures

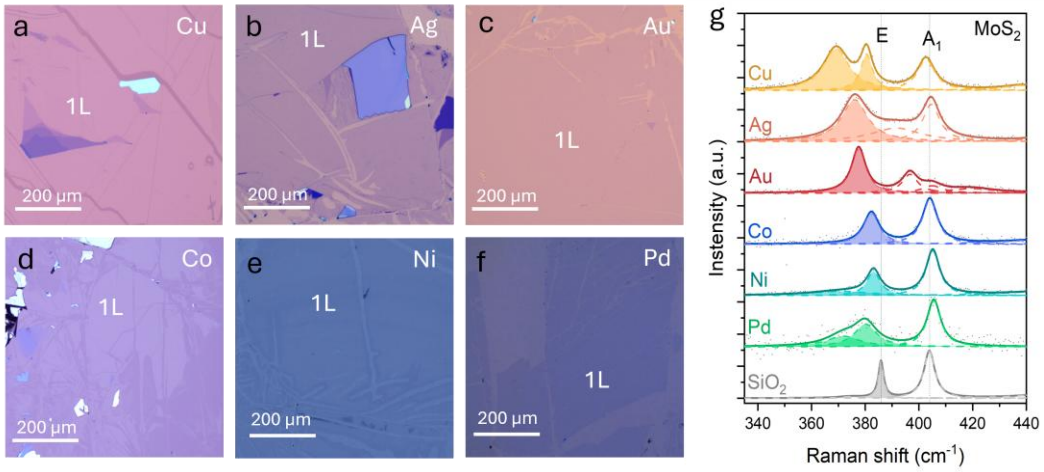

Figure 1: (a-f) Optical images of large-area MoS_2 monolayers exfoliated on Cu, Ag, Au, Co, Ni, and Pd. (g) Raman spectra of MoS_2 monolayers exfoliated on different metals.