Tuning the work function of Molybdenum disulfide by metal doping

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We have synthesized MoS_2 nanosheets by chemical exfoliation method and Au NPs are decorated on it. The structural analysis of pristine MoS_2 and Au NPs decorated MoS_2 has been done using X-ray diffraction and transmission electron microscopy. The effect of Au NPs decoration on the Fermi energy level of MoS_2 nanosheets have been monitored by scanning Kelvin probe microscopy, which measures the work function in terms of contact potential difference. The work function of pristine MoS_2 is found to be 4.994 eV, and it increases linearly for Au-MoS_2 with increasing concentration of Au NPs. The gradual increase in the work function values indicate a systematic shifting of Fermi energy level of MoS_2 towards valence band due to decoration of Au NPs. This is because the Au NPs act as trapping centre for electrons present in the conduction band of MoS_2. The energy corresponding to the conduction band of MoS_2 lies above the Fermi energy level of Au (5.1 eV). This favors the transfer of the free electron from the conduction band of MoS_2 to the Au NPs. This study can be useful for the basic understanding of MoS_2 nanosheets in order to use in electrical devices as well as in energy transfer studies where Fermi energy level plays crucial role in controlling the energy transfer efficiency.

References

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Figures

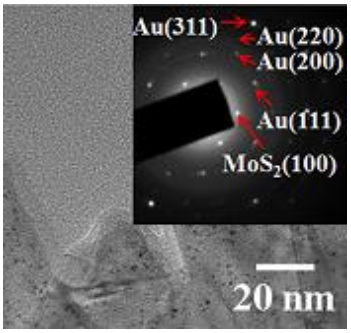

Figure 1: Au-MoS_2 with inset showing selective area electron diffraction pattern.

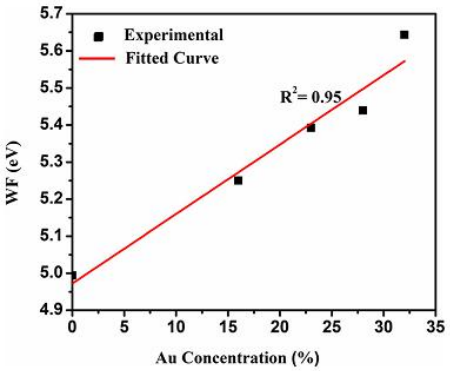

Figure 2: Variation of work function of Au-MoS_2 with respect to Au concentration.