Work function engineering by nanoshaving functionalised 2D materials

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Atomic force microscopy (AFM) can examine a variety of topographical, electrical and magnetic properties of sample´s surface at high resolution and can also be used to manipulate materials on nanometre scales. Here we employed a nanoshaving technique to ablate the surface layer of 2D materials with a certain force of the tip to the sample and subsequently investigate this with AFM imaging measurements [1].
Perylene diimide (PDI) was deposited onto CVD-grown monolayer transition metal dichalcogenides (MoS_2) which then self-assembles and non-covalently functionalisesl the 2D material [2]. In this study, Raman spectroscopy was first used to examine the surface and shows the successful removal of PDI after nanoshaving (fig. 1a, 1b). Kelvin probe force microscopy (KPFM) then gave access to the changes in work function of the shaved heterostructures comparing pristine, shaved and functionalised areas [3] (fig. 1c). This highlights the applicability of this technique in work function engineering of TMDs and allows for the defined structuring of organic layers for possible use in further applications.

References

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[2] H. Kim et al., Nanoscale, 10 (2018) 17557-17566
[3] L. Yan et al., Nano Letters, 11 (2011) 3543-3549

Figures

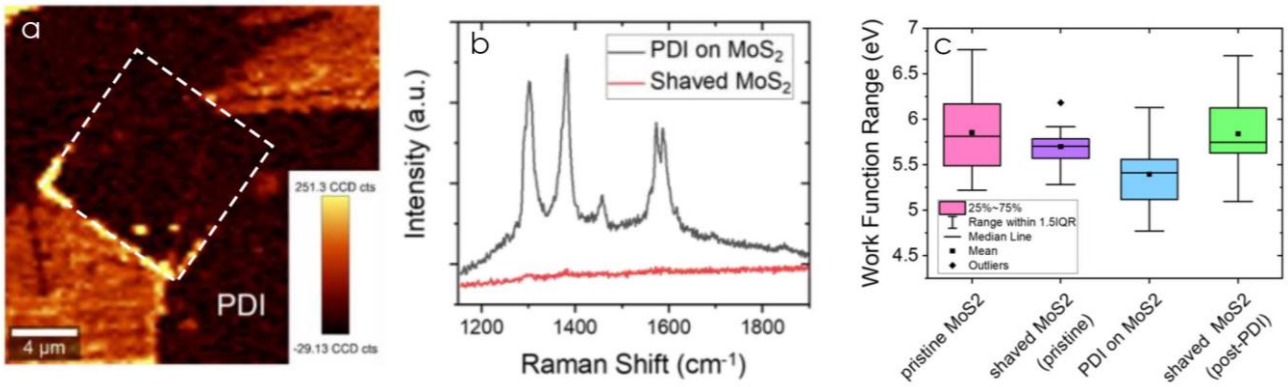

Figure 1: (a) Raman peak intensity map of PDI (1300 cm^{-1}) mode after nanoshaving of indicated area. (b) Raman spectra showing vanishing of PDI modes after nanoshaving. (c) Comparison of work functions of pristine and functionalised MoS_2 before and after nanoshaving.