Protecting the properties of monolayer MoS_2 on silicon based substrates with an atomically thin buffer

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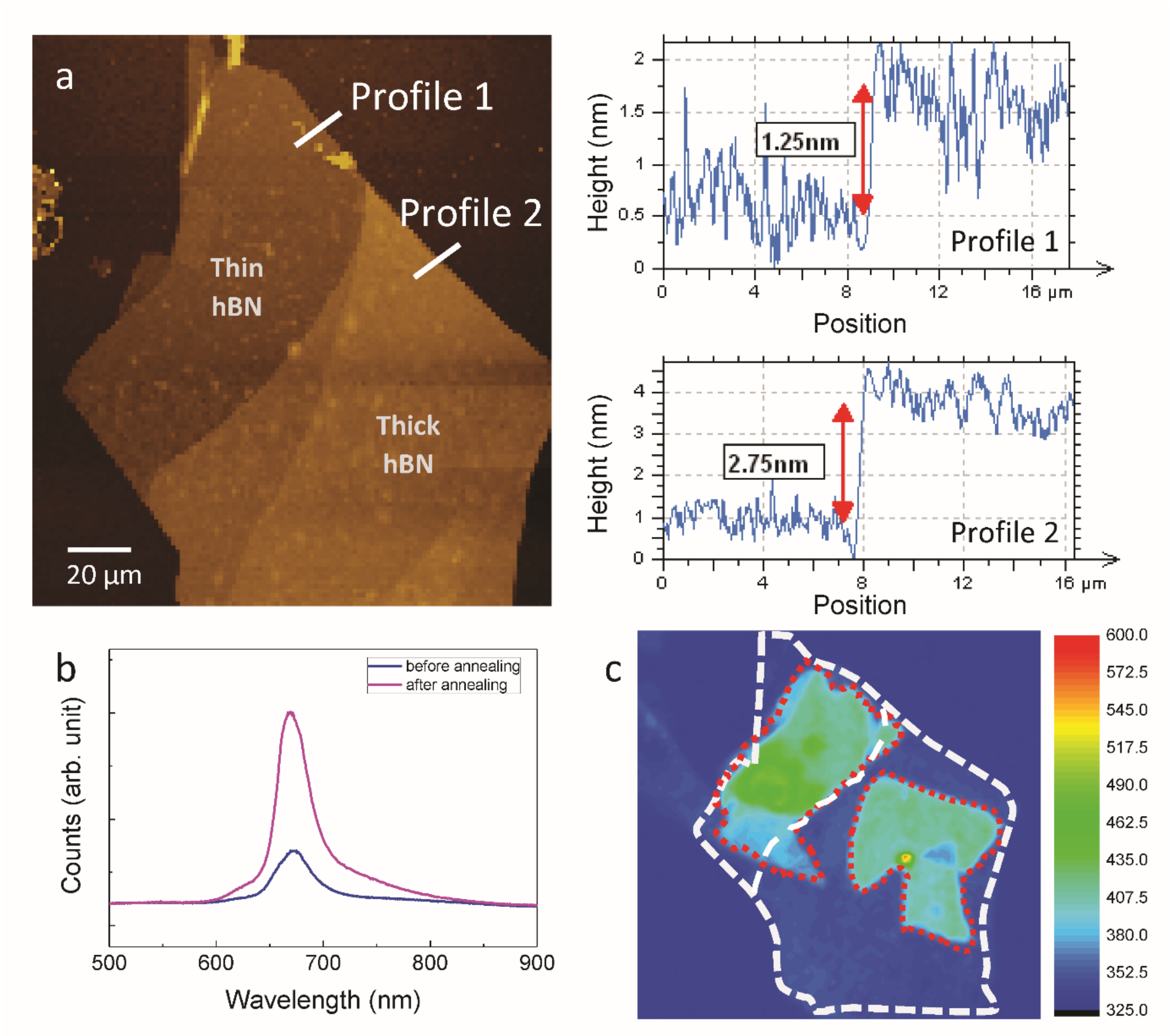
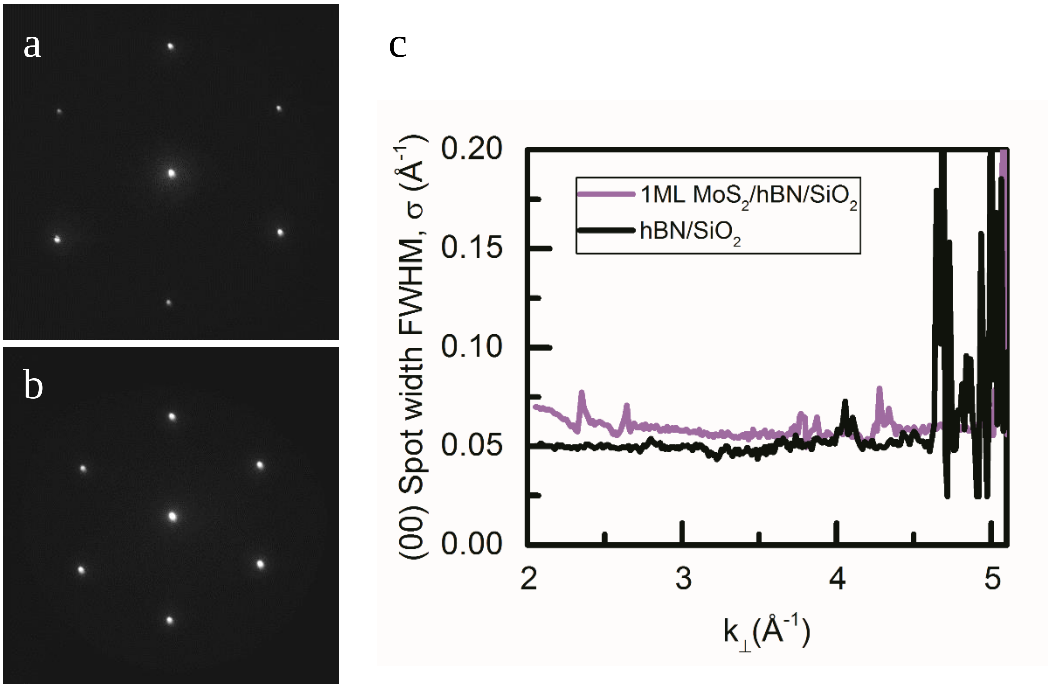
Supplementary Information



Supplementary Figure S1 | PL measurements for monolayer MoS_2 on top of an hBN buffer layer. a, AFM image of an hBN flake on top of a SiO_2 substrate. The line profile on the right shows that the thickness of hBN varied from 1.25nm to 2.75nm. **b**, shows the PL signal from monolayer MoS_2 flakes before and after the annealing-cleaning process. It shows that there is at least a 5x enhancement in the PL signal strength as a result of the annealing-cleaning process. **c**, shows a PL map of the MoS_2/hBN/SiO_2 heterostructure with monolayer MoS_2 (outlined in red) on top of the hBN flake (outlined in white). The thinner part of the hBN (top-left) is separated from the thicker part (bottom-right) by an extra dotted line in between. It shows that the PL signal strength for MoS_2 on hBN of different thickness is comparable, with MoS_2 on thinner hBN giving a slightly stronger signal, possibly due to interference effects.



Supplementary Figure S2 | Flat hBN buffer on SiO_2. Sharp µ-LEED pattern are taken from **a,** hBN region as thin as ~1nm and **b,** monolayer MoS_2 on top of the thin hBN (electron energy at 50eV). **c,** FWHM of the specular (00) diffraction beam – σ, versus incident electron wave vector $k_\perp$ shows that both thin hBN and the MoS_2 on top are extremely flat. Thus, even atomically thin hBN on SiO_2/Si is able to provide a stable flat platform for an overlaying monolayer crystal.