

Supporting Information

MoS₂ monolayers on Si and SiO₂ nanocone arrays: influences of 3D dielectric material refractive index on 2D MoS₂ optical absorption

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1. PL spectra of MoS₂ monolayers

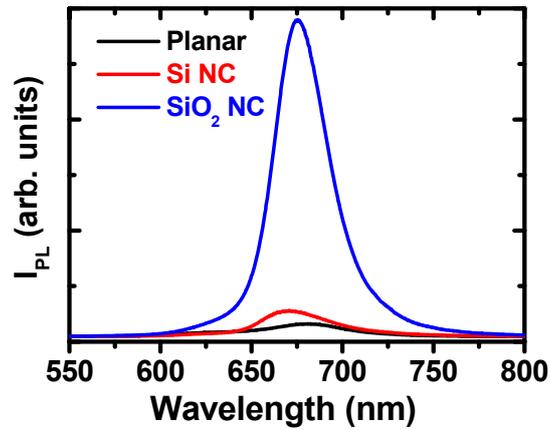


Figure S1. PL spectra of the MOCVD-grown MoS₂ monolayers on planar SiO₂/Si, Si NC, and SiO₂ NC substrates. The PL peak positions of all the samples are very similar. In particular, the PL peak of the planar sample appears at the wavelength of 680 nm, which is slightly longer than those of the NC samples (670 nm). This indicates no signature of the bandgap reduction of the MoS₂ layers grown on the NC substrates.

2. Raman spectra of the MoS₂-coated Si NC and SiO₂ NC

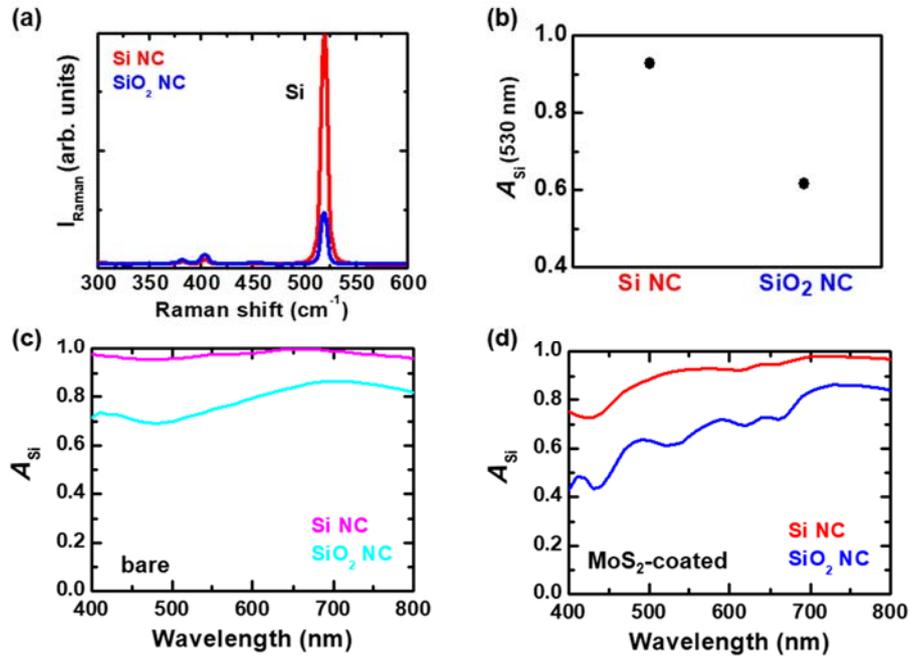


Figure S2. (a) The strong peaks at $\sim 520 \text{ cm}^{-1}$ originate from crystalline Si. The Si Raman peak for Si NC is significantly more intense than that for SiO₂ NC. (b) The calculated optical absorption in Si (A_{Si}) at $\lambda = 530 \text{ nm}$ (Raman excitation source) explains the sample dependence of the Raman peak intensity. A_{Si} spectra for (c) bare and (d) MoS₂-coated samples in the visible wavelength range. For the bare Si NC, A_{Si} is close to 1 across a whole visible wavelength range owing to the remarkable light trapping ability of HRI Si NC. Coating with the MoS₂ monolayers reduced A_{Si} . Reduction of A_{Si} is notable in the short wavelength region where the absorption coefficient of the MoS₂ monolayer is large.

3. MoS₂-coated Si NC and SiO₂ NC

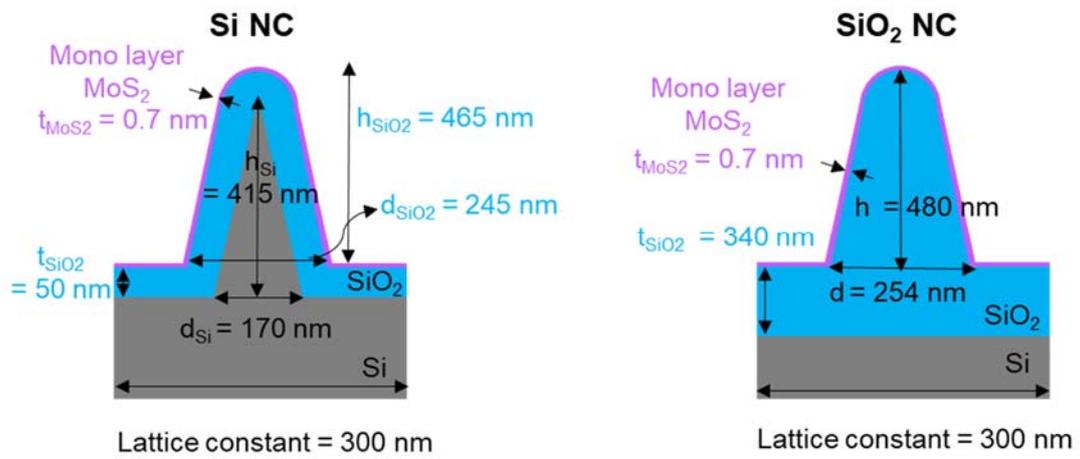


Figure S3. Schematic diagrams of the samples. The thickness of the SiO₂ layers and geometrical parameters of the nanostructures are included in the diagrams.

4. Growth of MoS₂ monolayers

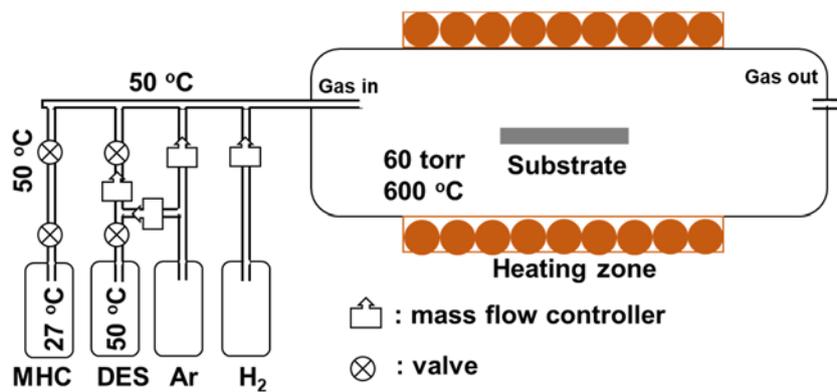


Figure S4. Schematic illustration of the metal organic chemical vapor deposition set up.