A strain tunable single-layer MoS_2 photodetector

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Strain engineering on 2D materials is an emergent research field [1]–[4] which aim is to tune the optoelectronic properties of a material by applying a deformation. The application of strain leads to a change of the lattice parameters that also produce a change in the bandgap. Until now, the works on biaxial strain have been focused on the exploration of the tunability of optical properties through the use of strain [5]. Nonetheless, the concept of strain engineering has barely being applied to electronic devices yet.
In this work, we apply biaxial strain to single-layer MoS_2 photodetectors by shrinking and expanding a flexible substrate (polycarbonate) by changing the temperature, exploiting the huge thermal expansion mismatch between the MoS_2 and the polycarbonate. Our results show a blueshift/redshift in the optical absorbance when the MoS_2 is shrunken/expanded. The photoresponsivity spectrum and the response time also change under the application of strain.
In summary, we successfully performed biaxial strain to obtain a tunable photodetector of MoS_2, opening the possibility to investigate the optoelectronic effect in other 2D materials [6].

References

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Figure

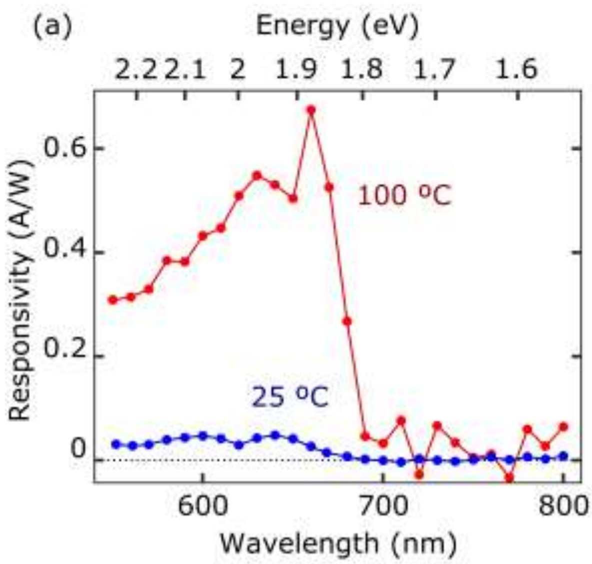

Figure 1: Responsivity spectra of the single-layer MoS_2 photodetector on polycarbonate obtained at 25 °C (blue) and 100 °C (red), so 0% and 0.48% of strain applied to the MoS_2 channel. Each dot corresponds to the value measured under light power of 8 mW/cm^2 and applying bias voltage of 10 V.