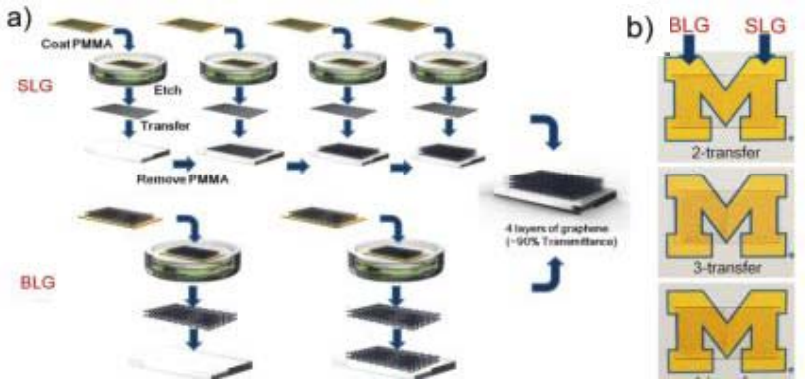
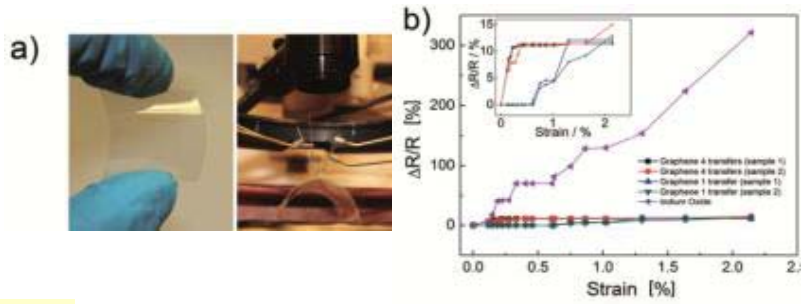
Homogeneous Bilayer Graphene Film Based Flexible Transparent Conductor

Graphene is considered a promising candidate to replace conventional transparent conductors due to its low opacity, high carrier mobility and flexible structure. Multi-layer graphene or stacked single layer graphenes have been investigated in the past but both have their drawbacks. The uniformity of multi-layer graphene is still questionable, and single layer graphene stacks require many transfer processes to achieve sufficiently low sheet resistance. In this work, bilayer graphene film grown with low pressure chemical vapor deposition was used as a transparent conductor for the first time. The technique was demonstrated to be highly efficient in fabricating a conductive and uniform transparent conductor compared to multi-layer or single layer graphene. Four transfers of bilayer graphene yielded a transparent conducting film with a sheet resistance of 180 Ω☐ at a transmittance of 83%. In addition, bilayer graphene films transferred onto plastic substrate showed remarkable robustness against bending, with sheet resistance change less than 15% at 2.14% strain, a 20-fold improvement over commercial indium oxide films.



(a) Schematic comparison of SLG method and BLG method to synthesize 4 layers of graphene stack to achieve lower sheet resistance. (b) optical comparison of SLG and BLG graphene stacks on glass substrate for 1,2,3,4 transfers.



(a) Photographs of graphene film on flexed PET substrate(left) and measurement setup of strained substrates (right). (b) Variation in resistance of stacked BLG films and indium oxide films on 200μm thick PET substrate as a function of strain values.

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