Ahmet Oral
Physics Department
Middle East Technical University
& NanoMagnetics Instruments Ltd. Ankara, Turkey

Flexible Multilayer Graphene Hall Sensors on Ultra-Thin PVC Foil

Having high charge carrier mobility [1] and superior elastic properties [2], graphene is a highly suitable material for flexible electronics. Although it does not produce a graphene film as smooth as an exfoliated graphene sheet transferred onto SiO_2/Si wafer, graphene transferred onto polymeric substrates could be used for flexible electronic applications that do not require very high charge carrier mobility. In addition, controlling the number of layers in synthesizing multilayer graphene will be an ability of great importance for applications involving resistances lower and charge carrier densities higher than that of single layer graphene. We developed a method for making multilayered graphene-based conductive films on 75μm-thick PVC foil via transfer printing of graphene by iterative lamination. The graphene is synthesized via atmospheric pressure chemical vapor deposition (APCVD) on 20μm-thick copper foils. After forming the Cu/graphene/PVC stack via lamination with hot rollers, selective etching with aqueous $FeCl_3$ solution is provided by hydrophobic permanent marker ink deposited onto the parts of the copper layer to become contact pads. The multilayered conductive films can be obtained by iterative application of this scheme in which the selective etching is applied after the last lamination. The conductive film based on single layer graphene manifested sheet resistances of the order of 1 kΩ and Hall coefficients of up to 1,200 Ω/T, and withstood current density greater than 1.9×10^9 A/m^2. The resistance and Hall coefficient values were found to decrease with increase in the number of layers. Our method could be used as a platform for proof-of-concept works aiming to demonstrate graphene's potential for flexible electronics. The structural, thermal, and electronic characterization of the multilayered graphene-based conductive films on the PVC foil is to be presented.

References

[1] Novoselov et al., Science, 5696 (2004) 666
[2] Lee et al., Science, 5887 (2008) 385