Development of a Piezoresistive Pressure Sensor Using Laser Scribed Graphene

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Pressure sensors are often used in applications in the areas of direct pressure sensing in weather instrumentation, aircrafts, automobiles, machinery and Altitude sensing in aircraft, rockets, satellites. Development of piezo resistive commercial pressure sensors is currently restricted to Silicon, Polysilicon thin film, bonded metal foil and sputtered thin film. Properties of graphene shows the potential to develop more accurate and cheaper piezo resistive pressure sensors. This research is focused on the development of such a graphene based pressure sensor for commercial applications. Major steps towards the success of the research was to reduce graphene oxide to graphene from laser scribing method so that chemical reduction steps are omitted and then to design and fabricate a functional pressure sensor.

In this research, graphene oxide was synthesized by modified hummers method. The prepared graphene oxide was characterized using FT-IR spectroscopy, XRD, TGA analysis and SEM. The sensors were fabricated using laser reduction of graphene oxide films that were coated on PET (polyethylene terephthalate) substrates. Sensor calibration was done and optimizing steps were taken for better functionality of the sensor.

Uniform films of graphene oxide were prepared by drop casting method. Laser reduced graphene oxide has shown an electrical conductivity comparable to chemically reduced graphene oxide. Functionality of the sensor was analyzed after calibration and significant resistance change with applied pressure was observed. Response time of the sensor was coupled with the design of the apparatus used. Laser reduced graphene has shown the potential to design simple, low cost pressure/strain sensors.

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