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Synthesis of graphene by thermal exfoliation of natural cellulosic material

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Graphene is a single-atom thick, two-dimensional sheet of carbon which has exceptional characteristics in chemical, electrical, material, and optical properties. There are different methods for preparation of graphene from graphite material which includes peeling of layers of graphite by micro-mechanical exfoliation method, thermal exfoliation, and chemical reduction of graphite oxide (GO), CVD method etc. All methods have some limitations like low production yield, cost, and impurity. These can be overcome by the present synthesis technique. Our method for synthesis of graphene and nickel (Ni) decorated graphene (graphene-Ni) from flower petals by thermal exfoliation. Flower petals are used as the source of carbon because of the carbon-carbon bonds present in cellulose and hemi-cellulose, undergo cleavage and molecular rearrangement at high temperature under anaerobic condition that eventually leads to the formation of graphene. Incorporation of Ni helps better exfoliation to produce the high quality graphene. Chemically treated flower petals are subjected to heat treatment above 800°C for 30 minutes in argon atmosphere. It is simple, eco-friendly; cost effective, and can be functionalised by various metals and easily produced in larger scale. Characterisation of synthesized graphene is done by Scanning Tunnelling Microscope (STM), Fourier Transformation Infrared Spectroscopy (FTIR). Sample prepared at 1000˚C has small amount of oxygen as revealed by FTIR results. A STM result shows the formation of graphene layers.

Biography

Harmeet Kaur is pursuing her under-graduate studies in Nanotechnology at Sri Guru Granth Sahib World University, Punjab, India.

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Dynamic mechanical and dielectric relaxation studies of silicon elastomer nanocomposites

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Dynamic mechanical and dielectric relaxation spectra of nano-graphite reinforced silicon elastomer nanocomposites were studied. SEM photomicrographs shows well dispersion of nano-graphite in silicon matrix. The primary relaxation has been studied by dynamic mechanical analysis as a function of temperature (-100°C to 100°C) at a frequency of 1 Hz and at 1% strain. Irrespective of the nano-graphite loading, all nanocomposites show glass-transition temperature in the range of -110C to -60C, which was explained on the basis of the relaxation dynamics of silicon matrix. Storage modulus and loss modulus shows elastic and viscous property of silicon nanocomposites as a function of temperature. Cole-cole plots show non-linearity in the nanocomposites matrix. The non-linearity in the tan δ and storage modulus was explained by the concept of nano-graphite silicon interactions and the aggregation of the nanographite. The secondary relaxation has been studied using dielectric relaxation spectra in the frequency range of 10-1-106 Hz. The capacitance of the nanocomposites has been expressed in terms of dielectric permittivity and explained on the basis of polarization of nano-graphite in the silicon matrix. Dielectric modulus formalism has been utilized to further investigate the conductivity and relaxation phenomenon. Argand diagram confirms the existence of non-debye type of relaxtion. The percolation threshold was found to be at 6 phr nano-graphite loading by conductivity and dielectric measurements.

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