



Opto-Mechanical Coupling in Polymer based Carbon Nanotube Composites

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Recent work has demonstrated that polymer / Multiwalled Carbon Nanotubes (MWNT) composites have a photo-mechanical coupling when the material is exposed to visible light. In this study we synthesized poly(dimethyl siloxane) (PDMS) based composites with two types of carbon nanotubes: pure carbon MWNTs and nitrogen doped MWNTs. The composites were prepared by dispersing MCNTs in a solvent with sonication after which the polymer matrix was added to the mixture. The composites were dried in a vacuum oven in order to completely remove residual solvent. Various composites with different CNTs concentration were prepared (0 vol. % to 2.5 vol. %). When the composites were exposed to a visible white light, they tended to contract or expand depending on the prestrain applied to the specimen. This phenomenon reaches an optimum for about 1% concentration, which may indicate the concentration of total light absorption. The composites that contain pure carbon MWNTs and the composites that contain nitrogen-doped MWNTs exhibit a similar behavior, but the magnitude of the effect is larger for the nitrogen-doped MWNTs. The composites were characterized by various experimental methods such as stress evolution as a function of the light wave length, coupled opto-resistive mechanical analyses, Raman spectroscopy, among others. The goal of the research is to correlate the MWNTs electronic structure to the photo-mechanical coupling properties.



Benjamin Fragneaud has done his Ph.D. in interchange between the institute of national applied sciences (Lyon, France) and the department of nanomaterial and nanotechnology of the IPICYT (San Luis Potosi, Mexico), where he received his Ph.D. from both Universities. The Ph.D research consisted in the synthesis of polymer grafted onto carbon nanotube surface and the study of composite material properties (mechanical and electrical) using this material as a load. Currently he works as a post-doctoral fellow at Columbia University in the Solid Mechanics Lab with Prof. Jeffrey W. Kysar. His research interests are in the field of polymer based composite and nanocomposites. He focused part of the postdoctoral research on the impact of coupled properties on the optomechanical response of materials such as carbon nanotubes.

Thursday, March 26, 2009
11:00-12:00pm am Seminar in 233 Mudd
Lunch served afterwards in MECE Lobby