Masaru Matsuo, J Nanomater Mol Nanotechnol 2018, Volume 7
DOI: 10.4172/2324-8777-C2-022

24th World Nano Conference

May 07-08, 2018 | Rome, Italy

Masaru Matsuo

Dalian University of Technology, China

Iodine-doping effect of nano-particle/polymer composites

Iodine-doping effect provided significant development of nano-particles/polymer composites. This presentation is concerned with two examples. 1) drastic increase in electric conductivity of iodine-doped carbon nanotubes (CNTs)/ultrahigh molecular weight polyethylene (UHMWPE) films, CNT content being beyond 4 vol%, elongated up to 50 times. Young's modulus of and conductivity of the composite reached 25 GPa and 0.1 S/cm, respectively. The mechanism responsible for the conductivity increase was analyzed by Raman spectroscopy in terms of bond polarization. The Raman spectroscopy indicated that doped iodine existed as I5- which acts as the charge carriers to form charge transfer complex. Namely, I5- provided an increase in charge carriers linked to the CNTs and could be taken as bridge for the adjacent or nearly CNTs. Thus, the iodine-doping contributed to development of the composite with high electric conductivity and high mechanical property. The high Young's modulus was due to extremely preferential orientation of UHMEPE chain axes with respect to the stretching direction. 2) preparation of tough titanium/carbon composite with smooth film surface with mixed types of anatase form and rutile form. Poly(vinyl alcohol) (PVA) and titanium dioxide (TiO_2) composite films were prepared by gelation/crystallization from dispersed solution containing TiO_2 particles against PVA. The incorporation of iodine into the composites was done and the iodine-incorporation composites were carbonized under argon gas in the temperature range of 700-1600°C. No disruption of the composite was found to be due to the appearances of Ti2O3 groups and the Ti-C structure performing cross-linking between neighboring amorphous carbon chains. Under the carbonization process, iodine-incorporation played an important role as a catalyst to promote the formation of the cross-linking between amorphous carbon chains through the resultant Ti-C structure that occurs by hydration. The coagulated TiO_2 powders in the composite film carbonized at 1200°C maintained a predominantly anatase-type as has been generally known as photo-catalytic activity. The perfect transition to the rutile-type dramatically occurred at 1600°C.

Recent Publications

1. Yuzhein B et al. (2008) Electrical and mechanical properties of iodine-doped highly elongated ultrahigh molecular weight polyethylene films filled with multiwalled carbon nanotubes Physical. Rev. B 77:035419.
2. Yumiko Nakano and Masaru Matsuo (2010) Carbonized properties of iodine-incorporated poly(vinyl alcohol) composite films prepared by gelation/crystallization from solution Physical. Rev. B. 26 (4):2857-2863.
3. Yanling Luo and Masaru Matsuo (2010) Morphology of carbon/TiC composite films prepared by carbonization of polyimide/titania composites. Polymer Bulletin. 64(9):939-951.
4. Shaoyan Fan et al. (2014) Dielectric change of copper phthalocyanine and polyurethane foam with high elasticity as a function of pressure discussed in terms of conversion from natural mechanical energy to electric energy. Macromolecules. 47(3):8281-8294.
5. Zhongyuan Lv et al. (2015) Magnetic behaviors of Mg and Zn-doped nanoparticles estimated in terms of crystal domain size, dielectric response, and application of Fe_3O_4/carbon nanotube composites to anodes for lithium ion batteries. J. Phys. Chem. C. 119(46):26128-26142.

Biography

Masaru Matsuo has completed his PhD at Kyoto University in Japan and was a Professor of Nara Women's University, Japan. After his retirement, he became a Full-Time Professor of Dalian University of Technology in China. Since September 1st (2014) he is a Visiting Professor at the same university. He has published more than 200 papers in refereed journal articles. He is IUPAC Fellow and Certificate of Membership Award of ACS (July 2015 - July 2018). He received "The Award of the Society of Fiber Science and Technology of Japan" in May 1990, "Paul Flory Polymer Research Prize" in April 2010 and "Certificate of Friendship Award of Liaoning Province in China" in September 2011.

mm-matsuo@live.jp