**Application of Nanofibers and Nanofilms based on Polymethacrylates and Polycarbonates**

UGC Major Project (2012-15), Status : Completed

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**Executive Summary**

Spinel ZnFe2O4 was prepared by spray pyrolysis using zinc nitrate and ferric nitrate as the raw materials and poly vinyl alcohol as the binding agent. The nanoparticles are then ultrasonically dispersed in PMMA solution and spin coated at 3500 rpm to form PMMA-ZnFe2O4 nanocomposite films. The VSM measurements explore that the PMMA-ZnFe2O4 nanocomposite film exhibits super paramagnetism at room temperature under an applied magnetic field.

Solid polymer blend electrolytes with constant PEO-PMMA-EC ratio and varying concentration of LiF are prepared by solution casting method. Ionic conductivities and dielectric properties of the polymer electrolyte samples at room temperature have been determined by a.c impedance studies. The effect of ZrO2 nanoparticles on the conductivity of PMMA-PEO-EC-LiF polymer electrolyte system was also studied. The ionic conductivity is found to be increasing as the ZrO2 concentration in the polymer electrolyte increases.

PMMA nanofibers with 5, 10 and 15 weight percentages of CdS are successfully fabricated by using a new combination of solvents which are not used by anyone before. The PL spectra of these composites show a sharp band edge emission and a supressed defect emission as compared to pure CdS nanoparticles. Sample C is found to have the least intense defect emission peak indicating the perfect encapsulation of CdS nanoparticles in the PMMA nanofibers. The thermal analysis of the samples shows that the decomposition temperature of PMMA nanofibers increases when incorporated with CdS nanoparticles.

Cobalt ferrite nanoparticles were prepared by a wet chemical method using hydrated ferric chloride and cobalt chloride with oleic acid as the capping agent. A new solvent mixture is introduced for dissolving PMMA very quickly other than the conventional methods. Different weight percentages of cobalt ferrite nanoparticles are sonicated into 10 wt% of PMMA solution. It is then electrospun and the fiber obtained is characterised by XRD, SEM, TEM. The interaction of cobalt ferrite nanoparticle with PMMA is identified by Fourier Transform Infra Red spectroscopy. Its magnetic properties of cobalt ferrite embedded PMMA fibers were studied by Vibrational Sample Magnetometer and the thermal nature of the fibers were also well characterised.

**NO. OF PUBLICATIONS OUT OF THE PROJECT**: 4 ( 3 more by next one year)

1.Effect of zirconia nanoparticle on the conductivity of PMMA-PEO-EC-LiF Gel Polymer Electrolyte System

Teena James, Benson Joseph, Arya Anil, Tomlal Jose E, S.B.Academic , Review 2012, 900-100, Vol XVIII, 1&2 ISSN 0973-7464

1. Magnetic Nanocomposites- Synthesis, Properties and Applications

Vishmujith U.R, Tomlal Jose E, New Numbers and Letters, An interdisciplinary Research Journal, 4,1,2013, ISSN 2320-8317

1. Enhanced Properties of Cadmium Sulphide (CdS) Dispersed Poly (Methyl methacrylate) Nanofibers (**Communicated to RSC Advances**)

Jacob K Chacko, Anoop Chandran, Tomlal Jose E, K. C.George, Arya Anil

1. A study on the morphology and magnetic properties of PMMA-Cobalt ferrite nanofibers

(will communicate soon)

Jacob K Chacko, Tomlal Jose E, Arya Anil

1. Structural, Thermal and Magnetic properties of PMMA-ZnFe2O4 nanocomposite thin films(will communicate soon)

Teena James, Tomlal Jose E, Subin P John, Jacob Mathew, Arya Anil, Gejo George.

**National Seminar Oral/ Poster Presentation: 3**

1. Structural and magnetic study of PMMA-Zinc ferrite nanocomposite films,

(Poster presentation, National Conference on Recent Trends in Materials Science and Technology, July 10-12, 2013, Organised by Dept. of Chemistry, Indian Inst. of Space Science and Tech. IIST-ISRO, Trivandrum)-Copy of proceedings attached

1. Eletrospinning for the functional naofibers of Polycarbonate and a Copolymer of Poly methyl methacrylate and Polystyrene

Thomas Baby, Vineetha Varkey, Sajeev U.S., Tomlal Jose E

Poster Presentation, National Seminar on Nanostructured Materials, 2014 August 12- 13, NSS Hindu College, Changanassery(UGC sponsored) ISBN 978-93-5174-895-3

1. Cure Characteristics and dielectric behavior of Cobalt ferrite filled Natural rubber Nanocomposites

Vishmujith U.R., Arya Anil and Tomlal Jose E,

Oral presentation, National Seminar on Nanostructured Materials, 2014 August 12-13, NSS Hindu College, Changanassery (UGC sponsored), ISBN 978-93-5174 -895-3

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