Military Technical College
Kobry Elkobbah, Cairo,
Egypt.

4th International Conference On Chemical & Environmental Engineering
27-29 May 2008

Work Shop Nº. 02

MATERIAL SCIENCE AND NANOTECHNOLOGY (MN)

AN OVERVIEW OF HIGH PERFORMANCE MATERIALS: NANOCOMPOSITES (PREPARATION, CHARACTERIZATION, PROPERTIES)

AHMED AKELAH*

ABSTRACT

An overview of structural materials types and scope will be covered since many of the modern technologies (nanotechnology) require materials with unusual combinations of opposite properties that can not be met by the conventional structural materials. Definition of nanocomposite materials and their types as well as their preparation, structure characterization and properties will also be discussed.

The molecular dispersion of Montmorillonite interlayers within polymers by intercalation grafting via ionic bonds has been used to produce organic-inorganic nanocomposites that exhibit the combination of high strength and high elasticity, i.e. high toughness. This goal has been attained by enhancing the Organophilic nature of the clay prior to interaction with polymers. Two techniques have been involved: i) intercalation of a suitable monomer (containing onium group and active group to be attached to the polymer backbone) to the MMT layers to produce Organophilic MMT, followed by subsequent condensation or radical polymerization of the monomers in which the polymeric chains are grown in the interlayers space (PS-MMT, PMMA-MMT, Vinyl Ester Resin-MMT, Epoxy Resin-MMT, Polyurethane-MMT, Phenolic Resin-MMT,Benzoxazine Resin-MMT), ii) direct intercalation of the positively charged polymer chains (ATBN Rubber-MMT).

The nature of the interaction bonding, the structure of the interlamellar spacing and molecular packing and morphological hierarchy of polymer-MMT nanocomposites have been examined by various analytical techniques. The ionic sites of the MMT layers occupied by polymers have been confirmed by elemental analysis and FTIR spectroscopy. The packing order of the polymer molecules within the interlayer space were examined by WAXD. The optical microscopies (SEM, TEM) have been used to show the effect of the polymer composition on the microstructure of the modified MMT material, which, in turn, affects the chemical and physical properties of the bulk and surfaces of MMT aggregates.

The properties of composite materials are influenced by the characteristics of particles of the dispersed phase and their morphological organization. There is a significant improvement of the thermal, elongation and flame retardance properties.

* Chemistry Department, Faculty of Science, Tanta University, Egypt