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## Preparation and Investigation of Flexural Strength and Impact Strength for Nano Hybrid Composite Materials of the Tri-Polymeric Blend used in Structural Applications

**Abstract-** Current work is aimed to preparation the nanocomposites laminates of low density and good durability to use in structural applications. So, in this paper, the preparation and compare of some mechanical properties of two groups of tri-polymer blends composites consisting of ((93% unsaturated polyester resin (UP)+(5%PMMA) (Poly methyl methacrylate)+2%NR (Natural Rubber)) as the matrix materials. Added the reinforce materials (silica (SiO<sub>2</sub>) and zirconia (ZrO<sub>2</sub>) nanoparticles) individually, with different volume fraction of (0, 0.5, 1, 1.5%) to the ternary polymer blends according to the following formula:- [((100-X) (93%UP)+2%NR+5%PMMA): (X%SiO<sub>2</sub> or X% ZrO<sub>2</sub>)] The first group is composed of matrix material reinforced with zirconia (ZrO<sub>2</sub>) nanoparticles with average diameter of nanoparticles (56.88nm) and the second group is composed of matrix material reinforced with silica (SiO<sub>2</sub>) nanoparticles with average diameter of nanoparticles (24.59nm). Then used as a matrix material for the preparation of hybrid laminar composites materials, reinforcement with one and two layers of woven carbon fibers The research included the study of the influence of volume fraction of nanoparticles on some of mechanical and physical properties like flexural strength, flexural modulus impact strength, and impact fracture toughness, in addition to test infrared spectroscopy (FTIR) and all of these tests were carried out at laboratory temperature. Search results have shown that the values of (flexural modulus and impact strength and fracture toughness) increases with the increase of the nanoparticles ratios in polymer blend nano composite of prepared samples. While flexural strength value decreases with the increase in the volume fraction of nanoparticles in polymer blend nano composite. The fracture energy of the of hybrid laminar composites is higher than those containing only the nanoparticles powders. Morphology test by scanning electron microscope indicates that a good adhesion or interfacial interactions between the Nano powders particles, carbon fibers and components of ternary polymer blend. Which results in higher the carbon fibers efficiency factor, and hence higher mechanical strength. So, the hybrid laminar nano composites, which appear high flexural modulus and impact strength and fracture toughness, can be foreseen to provide valuable contribution to high performance structural applications.

**Keywords-** PMMA, Unsaturated Polyester, Natural Rubber, hybrid Nano Composite nano-silica, nano-zirconia, flexural strength.

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