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The characterization of PMMA polymer with ZrO_2 nanocomposite films

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The composite films of Polymethylmethacrylate (PMMA) with ZrO_2 nanocomposite characterized by using FTIR over the range of wavenumber 3500-500 cm^{-1}. The morphological studies of these films were performed by using FESEM (Figure 1). The weight loss and melting temperature of the composite films for pristine and for irradiation by electron beam at dose rate of 100 kGy were measured using Thermo Gravimetric Analysis and Differential Scanning Calorimeter. The weight loss of the composite film after electron irradiation is higher than that of its pristine. It is observed from DSC that melting peak is occurred at temperature 397.52 ºC for pristine and at 395.94 ºC after electron irradiation. Hence, change in melting temperature is found to be 1.58 ºC. Polymer nanocomposites are a novel and fast-growing class of materials with nanosized filler domains finely dispersed in a polymer matrix. Polymer nanocomposites have improved physical properties such as thermal, mechanical, and dielectric properties as compared to conventional polymer composite due to the stronger interactions between polymer and filler phases [1, 2]. Their composites after electron irradiation exhibit degradation and modification. In current research, it has shown that small additions of certain nanomaterials modify the mechanical properties [3]. Here it is observed that the composite film before irradiation lost its weight 54.09% (2.912 mg) at 362.47 ºC and after electron irradiation it lost its weight 100.4% (6.090 mg) at 359.64 ºC (Figure 12). This reveals that the weight loss of the composite film is increased after electron beam irradiation.

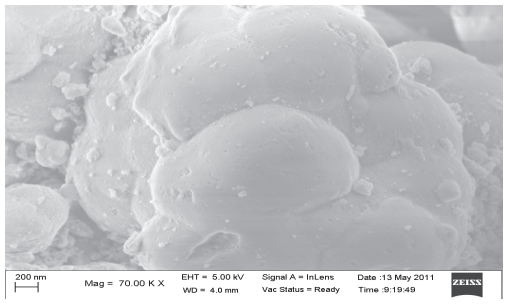

Figure 1: FESEM images of the PMMA composite films with ZrO_2 nanocomposite film

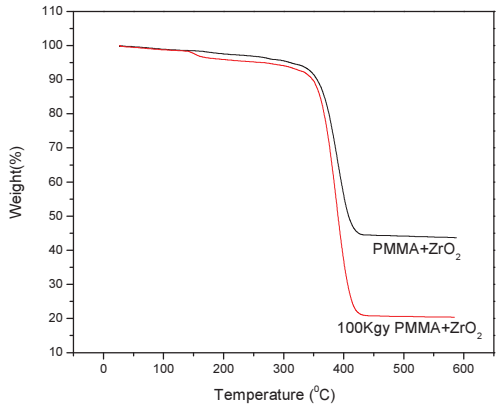

Figure 2: Plots of TGA for Pristine and after electron irradiation of the composite films

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