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Modification of Polystyrene using Rubber and Nano Fillers

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Abstract: Wastepolystyrene (Thermocol) was modified with rubber and nano clay by using two separate blending technique. In the first method polystyrene was dissolved in toluene, the rubber was added to the solute and finally nanoclay was added. In the second method nanoclay was added to rubber and the compound was added to polystyrene solution. The study shows that the first method result in better nanofillers dispersion and hence mechanical properties.

Keywords: polystyrene, rubber, nanoclay; solvent method, blending technique.

Introduction and Experimental

The effect of using both rubber and nanoclay together as the modifier is the topic of this paper. Waste thermocol was used as the polystyrene source. Modification was done by two techniques. Adding rubber and nanoclay together can bring down the amount of rubber required for efficient impact modification[6].

Route1: Waste thermocol is dissolved in toluene[4]. Rubber was added to the solute, after diffusion nanoclay was brought in to a dispersion with toluene and then it was added to the solution. Then the solution was casted into film and cut into small pieces and again mixed and was pressed into sheet and the sculpture was cut from the sheet for testing[3].

Route2: Nanoclay was added to the rubber in a rubber mill and was cut into small pieces and introduced into polystyrene solution. Then the solution was casted into film and the film was cut in to small pieces as before and again mixed and was passed into sheet and the sample were cut from the sheet for testing.

The addition of the nano clay concentration change the percentage of the thermocol depends. That means to adding the nanoclay 1 to 5% of the thermocol. To take both method this procedure was use and study the mechanical and thermal property of the polystyrene. The variation of the nanoclay to analyse the property variation of the polystyrene with more sample. Repeat the test in different amount of nanoclay[5].

Results and Discussion

Blending techniques have a significant effect on modification of polystyrene. Adding rubber and nanoclay separately to polystyrene is found to give better properties, this shows that better dispersion of nanoclay is obtained in the process as is evident from SEM images (Figure). Adding rubber and nanoclay together can bring down the amount of rubber required for efficient impact modification.

TGA measures the change in weight of a sample when it is heated, cooled or held at a constant temperature. The change in weight can be obtained as a graph against temperature or time. TGA analysis of the samples was done using 5-10 mgs of sample. Each sample was heated from 20°C to 600°C in nitrogen atmosphere. Heating provided 20°C per minute. Polystyrene is a very versatile general purpose polymer having excellent stiffness and processing behavior. But its usefulness is limited by its brittle nature. Traditionally polystyrene has been modified with rubber to improve its impact strength. 10 to 15% of rubber is usually added for the purpose. Nanofillers have now emerged as the ultimate modifiers for removal of moisture or trapped monomer if any. When the temperature reaches 380°C degradation started and reached maximum at a temperature of 440°C.

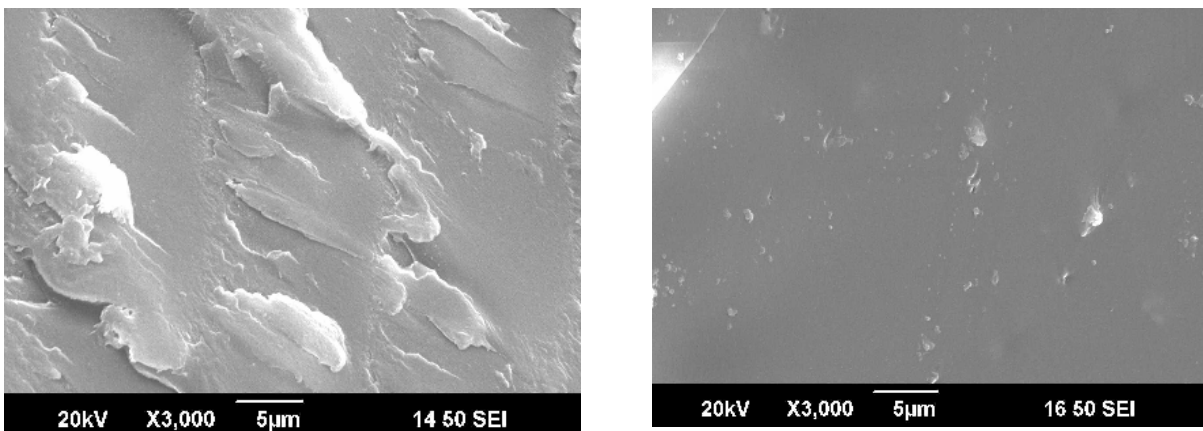


Fig 1. SEM micrographs of polystyrene (PS) and PB, PS and PB with nanoclay

Conclusion and future work

Blending techniques have a significant effect on modification of polystyrene. A better dispersion is achieved. Mechanical properties like tensile strength, flexural strength, impact strength etc have to be studied [1]. Model equations have to be developed from design of experiments.

References

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