Carbon and Inorganic Nanoparticles used to Reinforce Poly (Methyl Methacrylate) Nanocomposite Foams

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Introduction

Poly (methyl methacrylate) (PMMA) is a thermoplastic polymer which is used in various applications due to its excellent optical properties. It is a lightweight polymer with a density of 1.2 g/cm³. PMMA has a refractive index of 1.49. It is a clear, hard, and brittle polymer with a high glass transition temperature in the range of 100-130°C. The polymer is widely used in medical applications, optical materials, and as a protective coating. PMMA has been broadly pondered to improve its physical, mechanical, and optical properties by incorporating nanoparticles, such as graphene, carbon nanotubes, and inorganic nanoparticles. PMMA nanocomposite foams have been reported to have enhanced properties compared to the neat polymer. The main aim of this study is to investigate the effect of different nanoparticles on the properties of PMMA nanocomposite foams.

Description

Poly (methyl methacrylate)

Poly (methyl methacrylate) (PMMA) is a straightforward thermoplastic polymer. It is comprised of methyl methacrylate monomer. It was initially found in 1930s. It is a lightweight polymer with a thickness of 1.2 g/cm³. PMMA shows a refractive index of 1.49. PMMA has a formless nature, optical, detecting, and natural properties, comparative with slick PMMA [1].

In such manner, nanocarbon nanoparticles have been utilized to improve PMMA froth network properties. Research has turned towards the consolidation of nanocomposites, for example, graphene, carbon nanotubes, nanoclay, inorganic nanoparticles and so on in the PMMA network. Therefore, superior execution PMMA nanocomposite froths have been created. The unrivaled adaptability, warm solidness, mechanical vigor, electrical conductivity, detecting, capacitance, and radiation safeguarding properties of PMMA and nanofiller-based nanocomposite froths are suitable for a few specialized applications. In this audit, progress in the plan, elements, and utilisations of PMMA nanocomposite froths has been advertised. High level PMMA nanocomposite froths have been repeated in a few wide-running as well as promising application regions. The fate of PMMA nanocomposite froths depends on the plan of adjusted nanoparticle-based PMMA aerogels [2].

Poly (methyl methacrylate) foam

Polymeric nanocellular froths have been created utilizing different cycles. Among the most encouraging frothing strategies are supercritical carbon dioxide (CO₂) disintegration, the high strain technique, and the utilization of frothing specialists. The plasticization impact of frothing may impact the warm security, polymer glass change temperature, thickness, and mechanical properties. Slim polymer movies can be basically frothed utilizing CO₂ gas disintegration. Therefore, froths with medium-to-low thickness have been acquired. PMMA has been created to frame froth structures having low thickness, fine strength, unbending nature, and warm conductivity properties. PMMA froths have been created utilizing different polymeric techniques. Pinto embraced the CO₂ gas frothing cycle to shape nanocellular and microcellular PMMA froths. The impact of CO₂ immersion temperature on PMMA frothing was investigated. This addresses checking electron microscopy (SEM) pictures showing the impact of immersion temperature on the cell structure. The CO₂ immersion temperature appears to influence the frothing system by means of better nucleation and cell development. Zhou created PMMA microporous froth structures through hot liquefy squeezing. The dissolve technique was helped by the supercritical CO₂ frothing strategy. This shows the creation interaction for the PMMA froths. The PMMA was changed over into froth structures utilizing melt hot squeezing at 200°C (40 MPa). The PMMA sheet thickness was changed in the scope of 0.45-1.5 mm basically; single-layer PMMA sheet, 25-layer PMMA sheet, and 80-layer PMMA sheet were considered [4,5].

Conclusion

The volume thickness of the froths was found to diminish with climbing temperatures. This lessening in the volume thickness was likely because of the greater cell thickness of the froth at higher temperature. The compressive strength of the multi-facet froth was expanded from 11.84 MPa to 20.27 MPa with the rising PMMA layers in the design. The most noteworthy compressive strength was gotten with the 80 multi-facet PMMA sheet. Consideration of the multi-facet PMMA structure advanced better nucleation and development of the cells in the polymer grid.

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None.
Conflict of Interest
The authors declare that there is no conflict of interest associated with this manuscript.

References


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