

Preparation and Properties of Thin Polymer Films Prepared from Si-containing Compounds by Glow Discharge Polymerization

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The preparation of thermally-stable, polymeric and thin films by utilizing glow discharge polymerization technique; and physical properties of the polymers formed were investigated.

p-Xylene and benzene, firstly, were used as monomer for this aim, and light yellow or brown polymers were formed. The chemical structure of the polymers formed strongly depended on the operational conditions to sustain glow discharge, especially, the flow rate of the monomer. The polymers formed from both the monomers possessed good thermal stability corresponding to that of commercial poly (p-xylylene).

To seek more thermally-stable polymers the glow discharge polymerization in the tetramethylsilane (TMS) system was carried out, and colorless and filmy polymers were formed. The polymers formed were consist of Si-CH₃, Si-O-Si and Si-O-C groups, and their thermal stability was excellent, e. g., the weight loss at 500°C was approximately 20%. By mixing of inorganic gas such as N₂ and O₂ with TMS such elements were incorporated into the polymers to alter surface properties such as surface energy and surface hardness. The polymers formed from TMS were good in electric insulation. In a high electric field more than 10⁶ V/cm the Poole-Frenkel emission was observed.

The surface treatment by the glow discharge polymerization in the TMS system, finally, was applied for the improvement of adhesion between plastics and epoxide adhesive; and the successful improvement was done in polyethylene and polytetrafluoroethylene systems.