The Synthesis of Reflective and Electrically Conductive Polymide Films Via an In Situ Self-Metalization Procedure Using Silver (I) Complexes

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Abstract

Optical reflective polyimide films have been prepared by the incorporation of silver (I) acetate and a ß-diketone solubilizing agent, hexaflouroacetylacetone (HFAH), into a dimethylacetamide solution of the poly(amic acid) formed from 3,3',4, 4'-benzophenonetetracarboxylic acid dianhydride (BTDA) and 4,4'-oxydianiline (4,4'-ODA). Optically reflective and conductive polymide films have been prepared by replacing the ß-diketone (HFAH), with the less substituted ß-diketone, trifluoroacetylacetone (TFAH). The former system has been both cast directly from the poly(amic acid) resin and cast from the poly(amic acid) resin onto a fully imidized BTDA/4,4'-ODA case (formally a metallized topcoat). Thermal curing of the silver (I)-containing poly(amic acid) leads to imidization with concomitant silver (I) reduction, yielding a reflective silver surface, when HFAF is the solubilizing agent, and a reflective and surface-conductive silver surface, when TFAH is the solubizing agent. The metallized BTDA/4,4'-ODA films retain the essential mechanical properties of undoped films and have good thermal stability particularly in nitrogen atmospheres. The system which forms a metallized topcoat also exhibits the essential mechanical and thermal properties of the parent polymer while minimizing the silver required to form the reflective surface, and has outstanding metal-polymer and polymer-polymer adhesion attributed to mechanical interlocking. Films were characterized by X-ray, DSC, TGA, XPS, TEM, SEM, AFM.