Preparation, characterization and thermal degradation of Polyimide (4-APS/BTDA)/siO2 composite films.

ABSTRACT

Polyimide/SiO2 composite films were prepared from tetraethoxysilane (TEOS) and poly(amic acid) (PAA) based on aromatic diamine (4-aminophenyl sulfone) (4-APS) and aromatic dianhydride (3,3,4,4-benzophenonetetracarboxylic dianhydride) (BTDA) via a sol-gel process in N-methyl-2-pyrrolidinone (NMP). The prepared polyimide/SiO2 composite films were characterized using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscope (SEM) and thermogravimetric analysis (TGA). The FTIR results confirmed the synthesis of polyimide (4-APS/BTDA) and the formation of SiO2 particles in the polyimide matrix. Meanwhile, the SEM images showed that the SiO2 particles were well dispersed in the polyimide matrix. Thermal stability and kinetic parameters of the degradation processes for the prepared polyimide/SiO2 composite films were investigated using TGA in N2 atmosphere. The activation energy of the solid-state process was calculated using Flynn–Wall–Ozawa's method without the knowledge of the reaction mechanism. The results indicated that thermal stability and the values of the calculated activation energies increased with the increase of the TEOS loading and the activation energy also varied with the percentage of weight loss for all compositions.

Keyword: Polyimide; Silica; Activation energy; Thermogravimetric analysis.