

The Effect of Alkyl Terminal Chain Length of Schiff-Based Cyclotriphosphazene Derivatives towards Epoxy Resins on Flame Retardancy and Mechanical Properties

ABSTRACT

A series of Schiff-based cyclotriphosphazenes with different alkyl chain length terminal ends, 4a (dodecyl) and 4b (tetradecyl), were synthesized and the structures were characterized using Fourier-transform infrared spectroscopy (FT-IR), and ^1H , ^{13}C , and ^{31}P nuclear magnetic resonance (NMR) and carbon, hydrogen, and nitrogen (CHN) elemental analysis. The flame-retardant and mechanical properties of the epoxy resin (EP) matrix were examined. The limiting oxygen index (LOI) of 4a (26.55%) and 4b (26.71%) revealed a good increment compared to pure EP (22.75%). The LOI results corresponded to their thermal behavior studied using thermogravimetric analysis (TGA) and the char residue analyzed under field emission scanning electron microscopy (FESEM). The mechanical properties of EP showed a positive impact on tensile strength with a trend of EP < 4a < 4b. The tensile strength went from 8.06 N/mm² (pure EP) to 14.36 and 20.37 N/mm², indicating that the additives were compatible with epoxy resin.