Development of sustainable polybenzoxazine-based organic–inorganic hybrid nanocomposites for high voltage insulator applications

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Aims and scope

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Abstract

The benzoxazines made from cardanol-aniline (C-a), bisphenol-A-aniline (BA-a), and bisphenol-F-aniline (BF-a) were separately reacting with paraformaldehyde through Mannich condensation reaction. Hybrid polymeric blends of binary and ternary compositions were developed using DGEBA, C-a and BA-a/BF-a matrices. Bio-silica was obtained from rice-husk, which was functionalized using glycidoxypropyltrimethoxysilane, reinforced with combinations of binary and ternary blends of epoxy/benzoxazine resins, and then cured with triethylenetetramine (teta).

From thermogravimetric analysis, it was inferred that 100 wt% of bio-silica reinforced hybrid poly(C-a/BA-a/DGEBA) and poly(C-a/BF-a/DGEBA) composite samples possess better thermal stability than that of neat matrices. Among the composites, silica reinforced composites possess a lower dielectric constant than that of other composites. The value of break down voltage of 100 wt% of bio-silica reinforced polymer composites namely, poly(DGEBA-teta), poly(C-a 50wt%/DGEBA 50 wt%), poly(C-a/BA-a/DGEBA) and poly(C-a/BF-a/DGEBA) were observed at 25.93, 31.44, 31.74 and 32.30 kV, respectively. According to the data obtained from different experimental studies, hybrid composites made of epoxy resin and benzoxazine with bio-silica reinforcement possess better performance characteristics and can be considered a better suited material for high voltage insulation applications.

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