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# Enhanced Dielectric and Energy Storage Properties of the (200)-oriented Plate-like $Na_{0.5}Bi_{0.5}TiO_3$/Polyimide Composite Materials

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Ferroelectric/polymer composites capable of possessing high dielectric constant, excellent flexibility and withstanding high electric field have been considered as promising candidates for embedded capacitor applications, or other energy storage/transfer devices. However, conventional ferroelectric particle composites only exhibit high dielectric enhancement at a high fraction, and cannot withstand high breakdown electric fields. Compared with particle fillers, the plate-like ferroelectrics with obvious anisotropic dielectric behaviors exhibit excellent dielectric properties in a co-plane orientation. Here we reported a new polyimide based composite material with the (200) oriented plate-like $Na_{0.5}Bi_{0.5}TiO_3$ powders as fillers. The results showed that the plate-like $Na_{0.5}Bi_{0.5}TiO_3$ fillers lead to a obviously increase of dielectric constant for polyimide composites ($\varepsilon_r$=14.00) at a very low content when $Na_{0.5}Bi_{0.5}TiO_3$ content is about 5 wt%, which is 4.03 times as large as that of pure polyimide ($\varepsilon_r$=3.47) while maintaining a relatively low loss (tg$\delta$=0.0061) and high breakdown strength (1412 kV/cm). The measured energy density with 5 wt% $Na_{0.5}Bi_{0.5}TiO_3$ content increased to a value of 1.24 J/cm$^3$, higher than that of pure polyimide (0.67 J/cm$^3$). The result indicates that the composite could have potential applications in embedded capacitors and microelectronic applications.

**Keywords:** Polymer-matrix composites; Plate-like ferroelectrics; Dielectric constant; Energy density; Embedded capacitors

FULL TEXT

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