

Dielectric characteristics of epoxy resin modified with tetraethoxysilane in the millimeter range

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Abstract

In this work, the influence of alkoxy silanes introduced into the epoxy resin was studied. That was done in order to study the possibility of using the obtained binders in composite materials with increased radio transparency in the millimetre microwave radio band.

Determination of the modified epoxy resin dielectric characteristics in the millimetre microwave radio transparency was carried out by the waveguide method. The measuring complex consisted of a precision measuring line P1-31, a tunable generator on a Gann diode (30-38 GHz), a ferrite gate, and a section of a standard-section waveguide. Based on measurements of the minimum position displacement of the standing wave coefficient by known propagation constants, the free-space wavelength λ_0 for a given operating frequency, and the critical wavelength in the waveguide λ_{cr} , the loss angle tangent $\text{tg}(\delta)$ and the permittivity ϵ were calculated. Calculations of the permittivity ϵ , the angle of the dielectric loss $\text{tg}(\delta)$ and the radio transparency loss- ΔP were performed in the MathCad. Moisture absorption of samples was determined by holding them in a desiccator with a humidity of 98 %. The samples were kept in a tightly closed desiccator for 24 hours at a temperature of 25 °C. In addition, the relative moisture absorption was determined using the increase in mass.

It was found that the introduction of tetraethoxysilane in the composition in an amount of 1.5-3.5% leads to a decrease in the tangent of the dielectric loss angle. The optimum is observed in the range of the modifier concentration of 2.5-3.5%. This fact confirms that at these concentrations there is a complete interaction of TEOS alkoxy groups with epoxy resin epoxy groups.

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