

APPLICATION OF TERAHERTZ TIME-DOMAIN SPECTROSCOPY TO STUDY THE CURING PROCESSES OF EPOXY RESINS

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Epoxy resins are polymers which display unique resistances and mechanical properties: heat and chemical resistance, water resistance, dielectric properties. Due to their properties, epoxy resins are often used in the aviation, automotive, shipbuilding and electronics industries. The two components are mixed to start a chemical reaction which causes the resin to harden. In our work we show that the terahertz time-domain spectroscopy (THz-TDS) technique can be an excellent tool for monitoring the polymerization of the resin, since the curing process clearly changes its optical properties in the THz wavelength range.

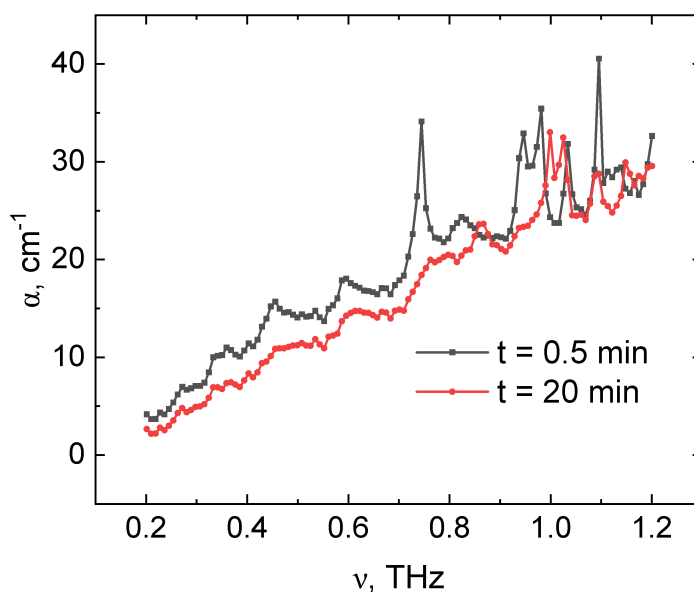


Fig. 1. Absorption spectra of liquid (black line) and solid (red line) epoxy resin.

As seen in Fig. 1, the absorption spectra of liquid epoxy resins are characterized by several absorption lines. As the resins cure, the center frequencies of some lines change, and some lines disappear. It was also found that the transparency of epoxy resins to terahertz radiation depend on their state: liquid, colloidal or solid. The least transparent epoxy resin is in a colloidal state; the most transparent - fully cured epoxy resin. The proposed measurement technique can be applied when creating various modifications of epoxy resin and monitoring the nuances of its drying. In a broader sense, our results indicate that THz-TDS methodology can be a useful tool for monitoring of chemical reactions.