P21

Terahertz time-domain spectroscopy for monitoring the curing of polymers.

Mykolas Šikas [1], Ihor Krapivin [1] and Ramūnas Adomavičius [1]

[1] *Center for Physical Sciences and Technology, Saulėtekio av. 3, LT-10257 Vilnius, Lithuania.*
Email: mykolas.sikas@ftmc.lt

In this study, the terahertz time-domain spectroscopy (THz-TDS) technique was employed to monitor the photochemical and polymerization reactions of epoxy resin. The curing process of six types of epoxy adhesives and five types of UV-curing adhesives was investigated.

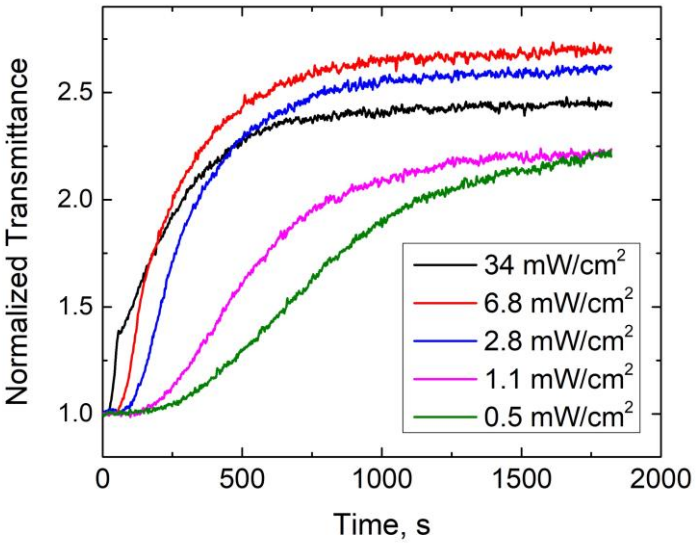

Fig. 1 Normalized transmittance of UV-curable adhesive at different excitation intensities of UV light. Probing radiation frequency - 0.2 THz. The start of the time countdown coincides with the switching on of the light source. The stabilization of transmittance at a constant level coincides with the hardening of the polymer

The terahertz absorption spectra of liquid epoxy resins are characterized by several absorption lines. During curing, the center frequencies of some lines shift, and some lines disappear. Additionally, it was found that the transparency of epoxy resins to terahertz radiation depends on their state: liquid, colloidal, or solid. The colloidal state of epoxy resin is the least transparent, while the fully cured epoxy resin is the most transparent.

When studying UV-curing adhesives, it became evident that the rate of the photochemical reaction depends on the intensity of UV radiation (Fig.1). It was also established that the refractive index of the hardened material varies with the intensity of optical radiation.

Our work demonstrates that the terahertz time-domain spectroscopy (THz-TDS) technique is an excellent tool for monitoring polymerization reactions, as the curing process significantly alters the optical properties of polymers in the terahertz wavelength range.