TERAHERTZ CHARACTERIZATION OF INKJET-PRINTABLE POLYMERS

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Additive manufacturing (AM) of terahertz (THz) components is a cost-effective and efficient method of rapid prototyping. This work discusses the THz characterization of AM-compatible polymers to evaluate their potential use in the fabrication of THz components. The materials under investigation are primarily used in the inkjet 3D-printing (IP) process, and are compared with other AM-compatible materials.

The IP process involves the deposition of ink droplets (liquids or solid suspensions) using multiple printing heads to form a layer-by-layer 3D structure on the print bed, which is subsequently cured with UV light or by solvent evaporation. A key advantage of IP is the relatively good printing resolution (~ 50 µm).

Using a Keyence Agilista Inkjet 3D-printer, the disc-shaped structures shown in Fig. 1a (5 cm in diameter and 1 cm in height) were manufactured using transparent AR-M2, heat resistant AR-H1, and flexible silicone-based elastomer (SE). These materials were characterized via THz time-domain spectroscopy [2]. As illustrated in Fig. 1b, the absorption coefficient (α) of SE (6.5 cm^{-1} at 0.4 THz) is much higher than that of AR-H1 (3 cm^{-1} at 0.4 THz) and AR-M2 (4 cm^{-1} at 0.4 THz). Other AM-compatible materials like HIPS and HDPE have similar absorption coefficients as that of AR-H1 and AR-M2, however, cyclic olefin copolymer (TOPAS) has a significantly lower absorption (α < 1 cm^{-1} at 0.4 THz) as per our previous research [1]. Thus, the materials AR-M2 and AR-H1 investigated in this work can be used in manufacturing of THz components, with the benefit of a superior printing resolution of 50 µm.

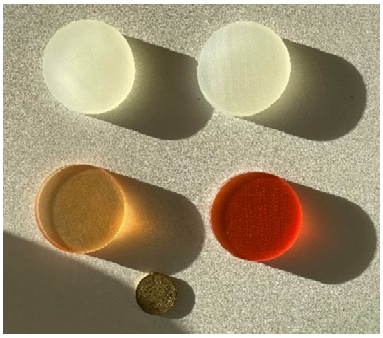
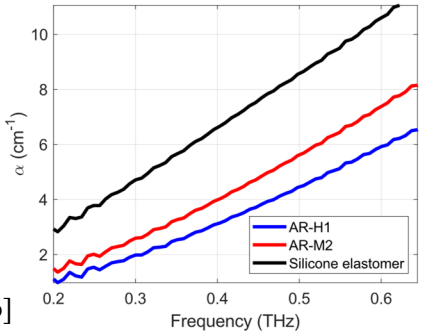
[a]  [b] 

***Figure 1**: **[a]** AR-H1 (white), AR-M2 (brown) and SE (red) samples, with **[b]** their attenuation spectra.*

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References:

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[2] F. R. Faridi, U. Nandi and S. Preu, "1.5 Port Vector Spectrometer for Terahertz Time Domain Spectroscopy," 2018 43rd International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), Nagoya, Japan, 2018, pp. 1-2, doi: 10.1109/IRMMW-THz.2018.8510415.