Thermoelastic and optical properties of PLLA estimated by photoacoustic measurements

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Polylactides, like all polymers, are materials with low coefficient of optical absorption. Transmission photoacoustic measurements on such materials require that a transparent sample be coated with a thin layer of good optical absorption, such as ink, dye or metal foil, in order to ensure optical opacity and to protect the microphone. The photoacoustic response of the Poly-(L-lactide) (PLLA), on which a thin layer of ink dye was previously applied, is measured in a minimum volume cell transmission configuration for two different positions of the two-layer sample: 1) the absorption layer is directly illuminated and 2) the transparent polymeric layer is directly illuminated. Thermal diffusivity, linear expansion coefficient and optical absorption coefficient of PLLA are determined by applying the boundary model of photoacoustic response for a two-layer sample in the case of optically thick and thermally thin absorption layer and self-consistent procedure for the inverse solution of the photoacoustic problem is derived. The obtained properties are in the range of literary expectations.

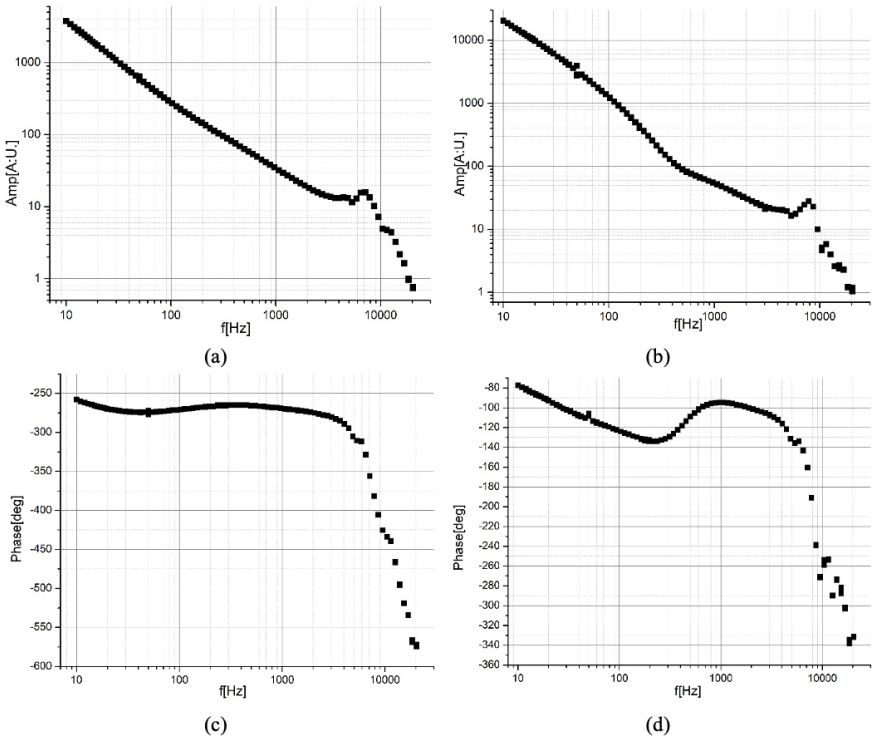

Fig. 1. Experimentally obtained photoacoustic response of 516 μm thick PLLA sample, coated with black acrylic dye 44 μm thick. Amplitude and phase characteristics when front-side illuminated **(a,c),** and when back-side illuminated **(b,d).**

References

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