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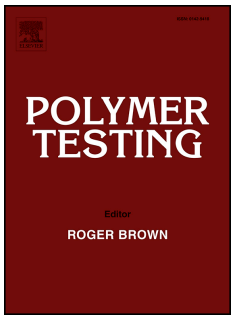

Measurement of the thermal conductivity of flexible biosourced polymers using the 3-omega method

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Test method

Measurement of the thermal conductivity of flexible biosourced polymers using the 3-omega method

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ABSTRACT

The thermal conductivity of flexible biosourced polymers was measured by the 3-omega method. Two biopolymers were investigated: the polylactic acid (PLA), a widely used commercial biodegradable one, and the cellulose palmitate (CP), a hydrophobic biosourced material developed in the laboratory, that could be used in electronic or microfluidic applications. The 3-omega method is based-on the use of a metal element as both heating device to thermally disturb the system and temperature sensor. A stencil lithography technique was applied to obtain metallic lines, since biopolymers are not compatible with classical photolithography method. Thermal conductivities of 0.19 and 0.30 W/m.K are obtained respectively for PLA and CP thick films, and 0.12 and 0.22 W/m.K for respectively PLA and CP thin films. These values are close to those measured for petro-sourced substrates or films and so give the possibility to address the applications mentioned.

1. Introduction

Bio-based polymers have attracted significant attention in recent years, because of their properties, such as high biocompatibility, good mechanical and dielectric properties, flexibility, low weight and optical clarity compatible with commodity plastic market [1]. Bio-based polymers are obtained from renewable resources by (*i*) biological synthesis (ex: polyhydroxybutyrate PHB), (*ii*) chemical synthetic pathway (ex: PLA, Braskem polyethylene) or (*iii*) extraction from plant resources (polysaccharides, lignins) [1, 2]. The availability and use of such materials could have a significant environmental impact, since it would drastically reduce wastes generated by conventional polymers [3]. Some of these biopolymers, such as PLA and native polysaccharides, have the advantage of being biodegradable, which makes them interesting

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