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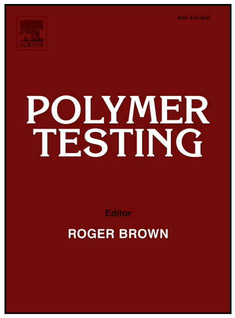

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Abstract
The material surface layer affecting sound absorption was identified by optical coherence tomography (OCT) image analysis. To characterise this layer, a special algorithm was developed to distinguish the polymer surface layer in thermoplastic composite materials, define its structure and thickness, and specify differences in these properties. The composite materials were obtained by thermal pressing of multilayer systems comprising viscose/polylactide and polylactide nonwoven fabrics, yielding thin polymer surface layers on the order of several hundred micrometres. The results of the measured sound absorption coefficient were analysed together with the OCT results. The use of OCT for the study of materials with specific acoustic characteristics was successfully demonstrated.

Key words: optical coherence tomography; sound absorption; surface layer; fibre; polymer; composite material

1. INTRODUCTION

Material thickness and density are important factors in determining the sound-absorbing qualities of a sound-absorbing material. There are two categories of sound-absorbing materials, i.e. porous absorbers and resonance absorbers. For porous absorbers, such as fibrous materials, thicker materials correspond to better sound absorption. For a material consisting of thermally pressed thermoplastic fibres, the thickness and density relate to the pressing conditions. In fibrous materials, the sound absorption coefficient typically depends on the sound frequency, i.e. absorption increases with frequency. Another character of this dependence can be observed for resonance absorbers, for which the maximum absorption occurs at the resonance frequency [1-5].

Apart from the type of material, the material surface characteristics are also important in determining the acoustic performance and sound absorption of a material. The effect of the surface layer on material sound absorption is thoroughly described in the literature and well known by acoustic engineers. Borelli and Schenone [6] investigated the sound absorption behaviours of polyester fibre materials of different thicknesses faced with perforated metal plates having varying percentages of open areas. Chevillotte [7] and Duval et al. [8] investigated the sound absorption of multilayer membrane structures theoretically and experimentally, respectively. Lee and Joo [9] compared the acoustic performances of nonwoven materials covered with polypropylene film and aluminium foil. Kalinova, Mohrova, and Ozturk et al. have investigated fibrous textile materials covered with electrospun nanofibrous membranes [4, 5, 10], describing the influence of nanofibre diameter, structure, and mass per unit area of the membrane on the acoustic performance.

Our previous studies [11] concerning fibrous thermoplastic composites showed that good sound-absorbing materials are characterised by surface structure asymmetry. This asymmetry consists of differences in the structures of two opposite material surfaces. For a material with same