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The effect of the microstructure and surface topography on acoustic properties of the composites for the lightweight medical cabins

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In this study we present the results of microstructure and acoustic properties of the composites for lightweight medical cabins. Small, lightweight and self-operated cabin can be a great tool to perform screening tests of the variable senses. This kind of cabin must meet a number of requirements, and one of them is good soundproofing. There are several problems to combine good acoustic properties and lightweight construction. A suitable acoustic properties can be obtained using special composite panels with the high surface topography, proper composite thickness and the proper type of filling. Therefore, in this study the microstructure and acoustic properties of several lightweight polyester resin – fiber glass composites were characterized. Analyzed panels differed in terms of thickness (3 and 10 mm), surface topography (geometrical diffuser or not) and type of filling (wool filling and high density polyurethane foam conglomerate).

For characterization purpose, the following methods were used: scanning electron microscopy observations, electron dispersive spectroscopy measurements and the density measurements. Special emphasis was placed on the measurements of the particle size, voids and their share in the matrix. Acoustic measurements where performed using unique acoustic equipment setup. Microscopic observations allowed to define small (approx. 3%) porosity, variable Gelcoat thickness and depict admixture size (average 2.74 μm) and their content in the matrix (about 16%). EDS analysis confirmed that particles present in the matrix are dolomite powder, which is commonly used as an additive to increase the strength of the composite and its contraction. Acoustic analysis showed that increased laminate thickness improves sound damping factors, that presence of the sound diffuser slightly reduces the length of the sound's decay and more dense filling improves both of this parameters.

The results show high potential of analyzed composites as lightweight construction materials with simultaneous good sound absorption properties

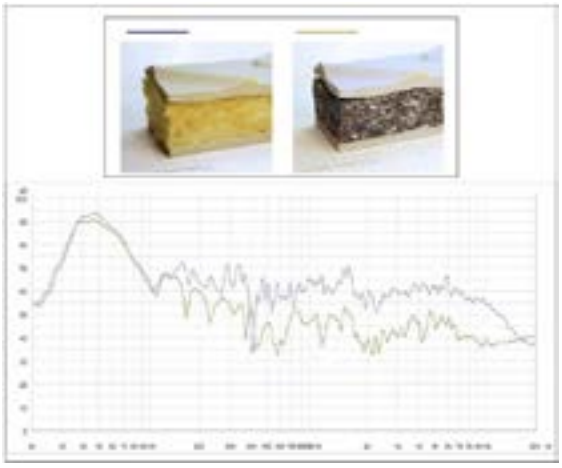

Figure 1. Sample sound damping characteristic of two different composite panels

Biography

Donata Kuczynska is a PhD student and has her expertise in evaluation of surface properties of the materials, especially in biomaterials. Her main interest is interaction of titanium surface with the plasma proteins (albumin and fibronectin) and cells. She deals with comprehensive surface characterization of physicochemical properties such as: chemical composition, roughness, topography, wettability and surface free energy. She has experience in surface analysis techniques - AFM Atomic Force Microscopy, Optical Profilmetry, XPS Spectroscopy, Auger AES Spectroscopy and Fourier FTIR Spectroscopy. Currently she is working on laser surface texturing of titanium and its alloys.

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