Book of Abstracts

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An influence of fatigue and fabric orientation on dynamic properties of the Elium acrylic resin reinforced by glass fibers

Wpływ zmęczenia i fabrycznej orientacji na dynamiczne właściwości żywicy akrylowej Elium zbrojonej włóknami szklanymi

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This paper is devoted to the characterization of the fully recyclable thermoplastic ELIUM acrylic resin reinforced by glass fabric woven that belongs to a new category of materials requiring advanced testing before their application in responsible elements of engineering structures. Its high strength, low weight as well as low production cost give an excellent opportunities to its wide application in the automotive industry as a replacement of the thermoset-based laminates. A bidirectional glass fibers fabric (plain weave glass fabric) provided by Chomarat Textiles Industries were used as the reinforcement [1]. The material consisted fibers intersecting themselves in the warp and weft directions. According to the datasheet, the fabric has the same properties along both these directions. The repetition period of the fabric pattern is $T = 7.8\ mm$ and its fabric mass area (surface density) is close to $ds = 600\ g/m^2$.The study presents an experimental work concerning the effect of damage due to low and high cyclic fatigue aging of two groups of specimens, first with the woven fabric orientations of $[0°/90°]_4$ and the second of $[45°/45°]_4$, on the low impact velocity properties. The impact resistance was measured in terms of load peak, absorbed energy, penetration threshold and dam-age analysis. The low velocity impact results indicate that the uniaxial cyclic loading (fatigue aging) of the material leads to the reduction of impact resistance, especially at the high impact energy levels. SEM and CT scan observations reveal that the damage area growing with the increase of both strain amplitude and impact energy.

Reference

[1] T. Libura, R. Matadi Boumbimba, A. Rusinek, Z.L. Kowalewski, T. Szymczak and P. Gerard, 2021, Effect of uniaxial fatigue aging and fabric orientation on low impact velocity response of glass fibres/Elium acrylic composite laminate, Materials, 14, 4089.