how these orientations influence the mechanical properties and behaviour of bolted joints. Utilising advanced numerical techniques, a detailed multi-scale finite element model incorporating the LaRC05 failure criteria was meticulously constructed. This model was validated against a robust experimental framework that included load-displacement measurements and micro-computed tomography (micro-CT) scans. Experimentally, the study involved conducting double-lap bearing tests on four different composite cases, each distinguished by unique fibre orientations around the bolt holes. To enhance the understanding of the underlying damage mechanisms, digital image correlation (DIC) and micro-CT scanning techniques were employed. These techniques provided a detailed view of the damage identification within the composites, thereby facilitating a deeper understanding of the structural behaviour. The findings from the experiments reveal that steering fibres around bolt holes substantially mitigates stress concentrations and enhances load transfer capabilities, crucially improving bearing performance. Notably, changing the fibre orientation by 180 degrees effectively distributes strain more uniformly and reduces the maximum absolute strain value by about half. This strategic manipulation of fibre paths significantly enhances initial damage resistance and delays crack propagation, critical factors for the longevity and reliability of jointed structures. The numerical simulations point out the crucial role of filament continuity in preventing premature failure and optimizing the load distribution across the joint. This aspect of the study highlights how different orientations of the steered fibres influence shear-induced damage propagation and overall composite performance. The multi-scale model provides crucial insights into potential enhancements in composite performance through strategic fibre steering, offering a powerful tool for designing advanced composites. The study's findings, supported by the numerical model, lay down a comprehensive framework for designing advanced composites using additive manufacturing techniques. This approach not only addresses existing research gaps in modelling composite joints but also introduces new possibilities for industrial applications, especially in sectors such as aerospace, where customised material properties can lead to substantial enhancements in design and functionality. In conclusion, by integrating additive manufacturing with advanced numerical modelling and optimization methods, this research presents a transformative approach to the development of composite materials. The ability to control the orientation and continuity of carbon fibres reveals significant opportunities to enhance the mechanical properties and performance of CFRP composites. This innovative methodology promises to revolutionize applications in high-performance engineering fields, leading to the creation of more efficient and robust designs tailored to specific performance needs. The convergence of experimental insights and numerical tools in this study not only fosters a deeper understanding of composite behaviour but also catalyses the development of next-generation materials that are both resilient and adaptable to diverse operational demands.

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abst. 1273
TEODORICO
Wednesday
September 4
16h30

The interface role in Al2O3/AlSi12 composite

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The composite is created via an interpenetration procedure by introducing a liquid aluminum alloy (AlSi12) into an alumina skeleton under pressure. Both materials, representing two phases of the composite, create interface layers between them. The skeleton is modeled as elastic brittle, and the matrix is elastic-plastic. The presentation evaluates the shape and fracture of the sample during impact. CT scanning determines the composite's microstructure, obtaining information about the sample's internal structure. [1] shows the importance of interface modeling. [2] evaluates the interface properties at the microscale. The results enhance the role of the interface. Acknowledgement The results presented in this paper were obtained within the framework of research grant No. 2019/33/B/ST8/01263 financed by the National Science Centre, Poland. The numerical analyses were done and in CYFRONET in Kraków, Poland and on LUMI, Finland. References [1] Postek, E. and Sadowski, T. Qualitative comparison of dynamic compressive pressure load and impact of WC/Co composite. Int. J. Refract. Hard. Met. (2018) 77: 68-81. [2] Tahani, M., Postek, E., Sadowski, T. Investigating the Influence of Diffusion on the Cohesive Zone Model of the SiC/Al Composite Interface, Molecules, (2023) 28: 6757-1-6757-19.

Additive manufacturing method for manufacturing composite structures with embedded fibre Bragg grating sensors

abst. 1285
TEODORICO
Wednesday
September 4
13h10

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Fibre reinforced polymers (FRP) have recently very popular in many branches of industry. Their wide applicability is linked with a requirement for structural health monitoring (SHM) systems. Such systems can determine the real loading conditions as well as the operational time of a structure. One of the sensor types is a fibre Bragg grating (FBG) sensor that can be used for strain measurements. Due to the geometrical and mechanical features, FBG sensors can be embedded into FRP elements during their manufacturing processes. Nowadays, an increasing popularity of additive manufacturing (AM) techniques is observed because they allow the fabrication of complex elements with a limited amount of waste. The paper aims to present the AM method for manufacturing FRP elements with embedded FBG sensors. The utility of the sensors for SHM will be analysed on thermal loading. Additionally, the influence of embedded optical fibres on the mechanical strength of the samples will be analysed based on the tensile test. The achieved results will be compared with the numerical ones (finite element method) or the experimental ones performed on composites with similar structures but manufactured using standard fabrication techniques. It is worth mentioning that AM composite structures differ from similar composites manufactured using standard methods. It will be analysed using NDT techniques, like THz spectroscopy.

Maximizing Sustainability: Enhancing GF-ABS Mold Recycling for Large Format Additive Manufacturing

abst. 1294
TEODORICO
Wednesday
September 4
10h40

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Large Format Additive Manufacturing (LFAM) has stablished as a promising process to produce molds for large scale components across many industries. However, considering the relative early-stage development of these manufacturing techniques, the life cycle of these molds is very short. Basically, they go to waste once the number of desired components had been produced using such mold. Previous studies demonstrated the feasibility of recycling machining waste or virgin material by itself. Therefore, to improve their life cycle, this study delves into the characterization of recycling end life molds of glass fiber reinforced acrylonitrile butadiene styrene (GF-ABS) produced by LFAM. The recycling process consists of milling and processing the shredded material into feedstock, disregarding the recurrent repalletization to minimize the process cost. Consequently, a complete parametric study is conducted to analyse the mechanical properties of recycled GF-ABS. The printing parameters studied are deposition time per layer, nozzle temperature and extrusion factor. Standardized tensile and flexure tests are performed, alongside thermal monitoring during layer deposition, resulting in stress-strain curves and heat transfer cooling rate tables. The results obtained are compared to those of pristine molds regarding tensile