Experimental and numerical determination of the fracture strength of PA12 material on specimens produced by selective laser sintering

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Abstract:

This paper presents the influence of geometry on the determination of the stress intensity factor KI on specimens produced by the selective laser sintering technique.The analysis of the determination of the stress intensity factor includes experimental and numerical tests. For this purpose, two geometries of specimens were used. Flat specimens with crack loaded in tension and ring specimens loaded on the inner wall. To understand the influence of geometry, specimens and their identical models were tested with three different ratios between the width of the test specimens and the initial length of the crack. Both types of specimens used for this experiment were made from polyamide PA12 utilizing the SLS (selective laser sintering) additive manufacturing process. The specimens are tested using the Shimadzu AGS-X 100 kN universal equipment for measuring mechanical characteristics of materials. The tensile testing is complemented by the GOM Aramis 2M system, which is utilized for digital image correlation and surface displacement tracking. For the numerical analyzes, we used the finite element method (Abaqus CAE software) to determine the KI factor based on the experimentally obtained results. The values of stress intensity factor for PA12 material show some different results for different types of specimens and effects of the type of production technique. We will present all the results and detail of examination in this paper.

Key words: Tensile testing, Selective laser sintered specimens, Numerical simulation, Stress concentrator

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