Functional Lightweight Design for Additive Manufactured Vehicle Liftgate Door Hinge

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ABSTRACT

Additive manufacturing technology provides extraordinary handling of producing mechanical parts regardless of their geometric complexity which traditional way are not sufficient. Furthermore, in the global automotive industry, replacing body components with lightweight designs is an important advantage which distinguishes from competitors. In recent years, topology optimization used as a tool for optimum solutions throughout the product development phase. However, automotive manufacturers must think the global technical regulations. In this study, mechanical properties of different build directional (0°, 45°, and 90°) tensile specimens fabricated from aluminium alloy (AlSi10Mg) using direct metal sintering (DMLS) have been investigated. Specimens are analysed by the mechanical tensile test and the Vickers hardness test. As a case study the development of the vehicle liftgate door hinge will be presented, which has been topological optimized. Complex geometry hinges component designs are manufactured in EOS M290 additive manufacturing system using aluminium alloy (AlSi10Mg) powder. This paper presents, numerical and experimental solutions for behaviour of liftgate door hinge under the regulatory conditions. Referring to the results obtained, an interpretation was made to increase the use of potential of additive manufacturing technology in the automotive industry.

Keywords: Additive Manufacturing, Finite element analysis, Mechanical properties, Topology optimization, Vehicle door hinge

REFERENCES

[1] S. Yoder, S. Morgan, C. Kinzy, E. Barnesa, M. Kirkab, V. Paquitb, P. Nandwanab, A Plotkowskib, R.R. Dehoffb, and S.S. Babua, "Characterization of topology optimized Ti-6Al-4V components using electron beam powder bed fusion", *Additive Manufacturing*, Vol. **19**, pp. 184-196, (2018).

[2] Y. Saadlaoui, J.L. Milan, J.M. Rossi, and P. Chabrand, "Topology optimization and additive manufacturing: Comparison of conception methods using industrial codes", *Journal of Manufacturing Systems*, Vol. **43**, pp. 178-186, (2017).

[3] P. Zhang, J. Liu, A.C. To, "Role of anisotropic properties on topology optimization of additive manufactured load bearing structures", *Scripta Materialia*, Vol. **135**, pp. 148-152, (2017)