Auxetic materials are modern class of materials fabricated by altering the material microstructure. Unlike conventional materials, they exhibit a negative Poisson's ratio when subjected to a uniaxial loading. These materials have recently been gaining popularity within the research community due to their enhanced mechanical properties. High energy-absorption and impact-resistance are of primary interests of applying in automotive systems. In this study, the auxetic foam made of aluminium is used in vehicle bumpers. Initially, the auxetic aluminium foam is fabricated using tri-axial compression followed by heating to softening temperature and cooling down gradually to ambient temperature. The amount of energy-absorption and impact-resistance of the auxetic is then measured. The effect of auxetic fabrication parameters such as heating time, heating temperature and volumetric compression ratio on energy-absorption and impact-resistance have been examined in this research. The optimized auxetic foam could then be adopted into the bumper system. Investigation on the energy absorbing system is carried out experimentally in two different loadings namely uniaxial compression and three-point bending test. Finite element model of the bumper system using commercial nonlinear finite element code is validated by using experimental test on the bumper system. Subsequently, the validated numerical model is employed to investigate and compare the energy absorption performance of conventional foam bumper and auxetic foam bumper. Both the experimental and modeling results indicate that amount of auxeticity directly make contribution to improvement of foam as an energy absorber in automotive industry.

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