



**EXPERIMENTAL AND NUMERICAL
ANALYSIS OF COMPRESSION LOAD
IN 3D PRINTED FUNCTIONALLY
GRADED FOAMS**



A PROJECT REPORT

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in partial fulfillment for the award of the degree

of

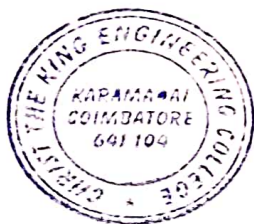
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in

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BONAFIDE CERTIFICATE

Certified that this project report "EXPERIMENTAL AND NUMERICAL ANALYSIS OF COMPRESSION LOAD IN 3D PRINTED FUNCTIONALLY GRADED FOAMS" is the bonafide work of DEVARAJ R (710419114016), HARIPRASATH M (710419114023), VIGNESH S (710419114309), VARSHA C (710419114901), who carried out the project work under my supervision.


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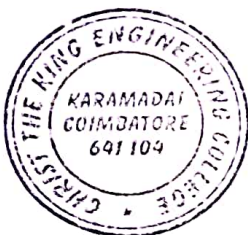
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INTERNAL EXAMINER




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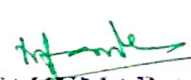
ABSTRACT

Functionally graded materials (FGMs) are novel composite materials with the gradual variations in their compositions and structure throughout their volume and hence locally tailored properties. The FGM scan be manufactured by using metal foams, polymer foams. Polymer foams find a wide range of applications, including in pillows and mattresses, physical insulation, furniture, engineering materials, housing decoration, and electronic devices, etc. In comparison to metallic and inorganic (e.g., ceramic and glass) porous materials, polymeric porous materials are of interest as they are substantially lighter (because of their lower density), have lower cost, off era wide range of compressive strengths (from elastic to flexible to semi-rigid to rigid), and are producible at considerably lower temperatures using arrange of methods, including spray foaming.

The polymer foams were initially modeled in three different pore sizes varying across the volume. The configuration was 3D printed using a laser sintering metal additive manufacturing technique. Subsequently, quasi-static compression tests were conducted and their stress-strain curves were examined to as certain the proof stress of the configurations. A numerical simulation of the compressive behaviors of the foam was then conducted and the results were correlated with those from experimentation to quantify the error in simulation. The compression tests revealed that the compressive strength was a function of density and porosity of the polymer foams. Further, the numerical results of compression behavior were validated, with less than 5 % deviation from the experimental results for the foam configurations

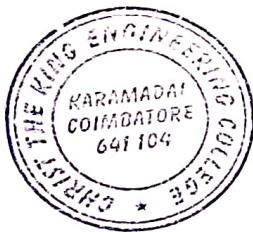
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6. CONCLUSION

In the present study, PLA foams of different pore sizes were modelled and 3D printed using Fused Deposition Modeling (FDM) process. The foams were subjected to compression and the stress-strain curves were plotted. Further, simulation studies were conducted on the foams and were compared with experimental results. The dimensional accuracy of the 3D printed porous PLA foams was observed to be accurate. The study revealed that the functionally graded PLA foam have significantly better energy absorbing capacity under low load condition in the linear elastic region and the densification of the cells is more in non-functionally graded foam which contributes greatly to the energy absorption of the foam. The simulation studies exhibited a proximate correlation with experimental results, signifying the validity of the numerical model.




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