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

A PROJECT REPORT

Submitted by

DEVARAJ R (710419114016)

HARIPRASATH M (710419114023)

VIGNESH S (710419114309)

VARSHA C (710419114901)

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ANNA UNIVERSITY: CHENNAI 600 025

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CHRIST THE KING ENGINEERING COLLEGE KARAMADAI COIMBATORE 641 104

Dr.M.JEYAKUMAR, M.E.,Ph.D.
PRINCIPAL
CHRIST THE KING ENGINEERING COLLEGE
Karamadai
Coimbatore - 641 104.

ANNA UNIVERSITY: CHENNAI 600 025

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.

SIGNATURE

Prof. R. HARI PRASATH

HEAD OF THE DEPARTMENT

Department of Mechanical Engineering
Christ the King Engineering College
Coimbatore – 641 104

SIGNATURE

Prof. V. PERUMALSAMY

SUPERVISOR
ASSISTANT PROFESSOR

Department of Mechanical Engineering
Christ the King Engineering College
Coimbatore – 641 104

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INTERNAL EXAMINER

EXTERNAL EXAMINER

CHRIST THE KING ENGINEERING COLLEGE
KARAMADAI COIMBATORE 641 104

Dr.M.JEYAKUMAR, M.E.,Ph.D
PRINCIPAL
CHRIST THE KING ENGINEERING COLLEGE,
Chikkarampalayam Village,
Karamadai Mettupalayam Taluk,
Coimbatore - 641 104.

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

6. CONCLUSION

In the present study, PLA foams of different pore sizes were modelled and 3DprintedusingFusedDepositionModeling(FDM)process.Thefoamsweresubjected to compression and the stress-strain curves were plotted. Further,simulation studies were conducted on thefoams and were compared withexperimental results. The dimensional accuracy of the 3D printed porous PLAfoams was observed to be accurate. The study revealed that the functionallygradedPLA foam have significantly betterenergy absorbing capacity underlow load condition in the linear elastic region and the densification of the cellsismoreinnon-functionallygradedfoamwhichcontributesgreatlytotheenergy absorption of the foam. The simulation studies exhibited a proximatecorrelation with experimental results, signifying the validity of the numericalmodel.

CHRIST THE KING ENGINEERING COLLEGE KARAMADAI COIMBATORE 641 104

Dr.M.JEYAKUMAR, M.E.,Ph.D.
PRINCIPAL
CHRIST THE KING ENGINEERING COLLEGE,
Chikkarampalayam Village,
Karamadai, Mettupalayam Taluk,
Coimbatore - 641 104.