

Numerical and experimental investigations of thermal conductivity of 3D printed polystyrene

C.E. Panaite¹, A.M. Mihalache², L. Slătineanu³, A. Popescu⁴, G. Nagîț⁵, A. Hrițuc^{6,*}, O. Dodun⁷

¹"Gheorghe Asachi" Technical University of Iași, Department of Automotive and Mechanical Engineering, Blvd. Mangeron, 43, 700050 Iași, România, epanaite@tuiasi.ro

²"Gheorghe Asachi" Technical University of Iași, Department of Machine Manufacturing Technology, Blvd. Mangeron, 59A, 700050 Iași, România, andrei.mihalache@yahoo.com

³"Gheorghe Asachi" Technical University of Iași, Department of Machine Manufacturing Technology, Blvd. Mangeron, 59A, 700050 Iași, România, slati@tcm.tuiasi.ro

⁴"Gheorghe Asachi" Technical University of Iași, Department of Automotive and Mechanical Engineering, Blvd. Mangeron, 43, 700050 Iași, România, aristotelpopescu@yahoo.com

⁵"Gheorghe Asachi" Technical University of Iași, Department of Machine Manufacturing Technology, Blvd. Mangeron, 59A, 700050 Iași, România, nagit@tcm.tuiasi.ro

⁶"Gheorghe Asachi" Technical University of Iași, Department of Machine Manufacturing Technology, Blvd. Mangeron, 59A, 700050 Iași, România, hrituc.adelina3295@yahoo.com

⁷"Gheorghe Asachi" Technical University of Iași, Department of Machine Manufacturing Technology, Blvd. Mangeron, 59A, 700050 Iași, România, oanad@tcm.tuiasi.ro

Keywords: polystyrene, thermal insulation capacity, 3D printing, numerical analysis, empirical mathematical model

Abstract. Polystyrene is a plastic material frequently used for thermal insulation of civil and industrial buildings. In such situations, some information is needed regarding the thermal insulation capacity specific to different categories of polystyrene. On the other hand, the development of 3D printing processes has led to ensuring the conditions for making polystyrene parts with properties that can be modified by varying the sizes of input factors in the printing process. An experimental research method was proposed and used, in which the temperature variation was observed on the surfaces of some polystyrene plates, under the conditions of applying a coolant on one of the surfaces of the polystyrene plates with different characteristics. The experimental results were processed using a computer program. An empirical mathematical model was obtained that highlights the influence of input factors in the 3D printing process on the thermal insulation capacity of polystyrene.

References

- [1] B. Doğan, and H. Tan, The numerical and experimental investigation of the change of the thermal conductivity of expanded polystyrene at different temperatures and densities, *International Journal of Polymer Science*, **2019**, 6350326.
- [2] A. Lakatos, F. Kalmár, Analysis of water sorption and thermal conductivity of expanded polystyrene insulation materials, *Building Services Engineering Research and Technology*, **2013**, 35, 3, 237-243.