

A STUDY OF GRID REINFORCEMENT AND UNWANTED PORES IN SYNTACTIC FOAMS ON COMPRESSIVE PROPERTIES

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In aerospace and automotive industries, one of the biggest problems in environment and finance topics is the CO₂ emissions of vehicles. They are obliged within some standards, below the permitted quota, to protect the environment while they still would like to provide high-performance vehicles to be competitive in their sectors. The main expectations in the automotive and aerospace area are high-speed vehicles with low fuel consumption. These expectations had become needs for reducing fuel consumption and reducing the harm for the environment by using less fuel. Many research and projects were carried out to find a solution to these challenges. A good solution for this problem is to use light-weight materials with high strength. In this manner, also according to the Ashby material selection charts, syntactic foams had become as a potential candidate of materials that could be used in this area.

The main topic of this TDK thesis is the investigation of the compressive properties of the syntactic foams. Syntactic foams are composite materials formed of two constituent materials called matrix and hollow spheres or particles with high porosity like expanded aggravated clay particles. Matrix materials are usually metal, ceramic or polymer while the hollow spheres are usually made of glass microspheres, polymers, or metals.

The main purpose of our investigations was first, to analyse the effects of unintentional pores on the compressive properties of aluminium matrix syntactic foam. Second, to investigate simple ways to increase the strength of these syntactic foams without significantly increasing the density of the samples, therefore we investigated the effect of grid reinforcements on the strength of aluminium matrix syntactic foam. We expected due to the previously reviewed literature, the samples with unintentional pores to have less yield strength and the samples with grid reinforcement to have higher energy absorption properties. We tested these properties by applying compression test to the samples. The samples which had been used during this work were aluminium matrix syntactic foams with lightweight expanded clay agglomerate particles

(LECAPs) inside as the porous particles. For the unwanted pores experiment the pores were formed by expanded perlite particles and for the grid reinforcement experiment steel grid was used. The samples were manufactured with low pressure infiltration method for both experiments.

We have found that the existence and the size of the unwanted pores affect the mechanical properties of the samples. The pores with the two times of the porous particles' diameter caused the highest decrease in the strength and stiffness of the syntactic foams. The location of the unwanted pore did not have a significant effect on the same properties.

We found that using a grid as a reinforcement can increase the energy absorption capacity, however, the specific mechanical values are lower for the reinforced samples.

This work could be helpful for the further research activities related on the syntactic foams. The amount of the grids can be changed, and the unwanted pore size can be varied in the further research.

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