INVESTIGATION OF LIGHT WEIGHT METAL FOAMS

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Eight types of MMSF blocks (36×55×170 mm) were produced. The microballoon content was maintained at 64 vol%. The specimens were investigated in as-produced (O) and heat treated (T6, according to ASM [20]) condition. The specimens were named after their constituents. For example AlCu5-SL150-T6 has AlCu5 matrix, ~64 vol% SL150 type microballoons and it is in T6 condition.

Cylindrical specimens were manufactured from the blocks (Ø14 mm, height: 21 mm). Six specimens were compressed from each type on a MTS810 type machine at 20°C and at 220°C. The stress–deformation curves were analyzed.

1. Introduction

Syntactic foams were produced in the sixties for the first time [1]. In metal matrix syntactic foams (MMSFs) porosity is originated from low density and hollow ceramic microballoons. Due to their excellent specific properties MMSFs have perspective applications in covers, castings, furniture and engine blocks, etc. The MMSFs usually made by pressure infiltration or by blending method [2-7]. On the other hand the compressive characteristics of the syntactic foams are extremely important, because compression is the main load type in the case of their potential applications [8-12]. For successful pressure infiltration a threshold pressure must be ensured, which can be estimated by theoretical and experimental methods [13, 14]. The matrix of the MMSFs is usually aluminium alloy. Between the microballoons and the matrix an interface layer can be formed. This layer ensures the load transfer between the hollow microspheres and the matrix [15]. The aim of this paper is to describe the main effects of temperature, microballoon size and heat treatment on the compressive behaviour of MMSFs.

2. Experimental Results

MMSFs were produced by pressure infiltration. Al99.5, AlSi12, AlMgSi1 and AlCu5 alloys were applied as matrix materials. The fillers were SL150 and SL300 type ceramic ((~35 wt% Al2O3 and ~65 wt% SiO2) microballoons supplied by Envirospheres Pty. Ltd. (Tab. 1.). We used a buoyant method to eliminate broken hollow microspheres from a batch. The infiltration temperature and pressure was ~700°C and ~0.4 MPa respectively.

<table>
<thead>
<tr>
<th>Type</th>
<th>SL150</th>
<th>SL300</th>
</tr>
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<tbody>
<tr>
<td>Diameter (μm)</td>
<td>100</td>
<td>150</td>
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</table>

Tab. 1: Average diameters of the microballoons

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The effect of matrix composition was similar in the case of both fillers (fig. 1). Due to lack of space the SL150 case is presented only. In solution treated condition (O) the Al99.5 alloy showed the lowest strength. As the strength increased the fracture strain began to decrease, but the absorbed energy remained almost the same.

![Fig. 1: Effect of the matrix composition.](image)

The larger microballoons caused lower compressive strength, however the difference was not significant (fig. 2.). The T6 heat treatment increased the compressive strength, but decreased the fracture strain, the energy was not changed (fig. 3).
3. Acknowledgements

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4. References