GLASSY CARBON PARTICLES AS A REINFORCEMENT OF MAGNESIUM MATRIX COMPOSITES

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Keywords: magnesium matrix composites, glassy carbon, interface

1 Introduction
The glassy carbon (GC) called also amorphous carbon is well known material because of it mechanical properties and first of all thermal and chemical stability. Composite materials can be another field of glassy carbon application, but in form of particles with variable granulation or as a matrix. Therefore glassy carbon particles were particularly proposed for tribiological applications [1] in composites with polymer and aluminium matrix. In the present paper an application of glassy carbon particles in magnesium matrix composite is reported [2,3].

2 Characteristic of Glassy Carbon Particles

2.1 Manufacturing
Glassy carbon particles (GCp) were manufactured according to the following recipe: a) polymerization of an organic resin, b) pyrolysis of organic precursor into GC, c) milling of GC, c) sieving of GC to proper fractions. Results of applied technological steps were presented at Figs 1-3.

2.2 Microstructure and Properties
Examination of GCp by X-ray diffraction method (XRD) confirmed their amorphous structure and observation by scanning electron microscopy (SEM) showed they characteristic irregular shape with sharp edges (Fig. 3). They microhardness was estimated as ~260HV. Our own experiments showed that GCp can be applied “as obtained” or surface modified with TiC or HfC nanolayeres formed by reactive chemical vapor deposition method (RCVD), with nanolayer of TiN deposited by chemical vapor deposition method (CVD) as well as with SiO2 nanolayer obtained by sol-gel method.

3 Magnesium Matrix Composite with Glassy Carbon Particles

3.1 Composite Microstructure
Composite samples were obtained from homogenous mixture of glassy carbon particles and pure magnesium or its alloys of variable composition. The consolidation process is in progress by wetting of solid state particles with liquid matrix. Independently on magnesium alloy composition the microstructure investigations shown the uniform distribution of particles and their good cohesion with a matrix (Fig. 4).

3.2 Interface Microstructure
Because of fundamental role of reinforcement-matrix interface properties its microstructure was investigated with SEM and TEM methods. It was found that during the wetting of glassy carbon and further cooling of the system the new phases (Fig. 5) were formed with composition dependent of applied GCp surface modification and magnesium matrix chemical composition. The effect of oxygen originally absorbed by carbon material and its reactions with metallic elements of magnesium matrix were always observed.

4 Summary
Results of laboratory and industrial experiments showed that glassy carbon can be applied in form of particles with variable granulation as a reinforcement of magnesium based composites. Properly selected technological parameters of the composite manufacturing ensured good wettability.
of GC by liquid matrix and the reactive bonding between components.

Fig.1. Macrostructure of GC organic precursor.

Fig.2. Macrostructure of GC before milling process.

Fig.3. Microstructure (SEM) of GC particles applied in experiments.

Fig.4. Microstructure (SEM) of magnesium matrix composite reinforced with GC particles.

Fig.5. Microstructure (SEM) of bonding formed between GC (left) and magnesium matrix (right).

Acknowledgements
This work was supported by the Polish Ministry of Science and Higher Education (project Nr15-0077-10/2010).

References