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First attempt to obtain high-strength ductile biodegradable Zn alloys by rapid solidification and subsequent high-pressure torsion

Wiktor Bednarczyk[a], Maria Wątroba[b], Grzegorz Cieślak[a] , Małgorzata Lewandowska[a]

[a] *Warsaw University of Technology, Faculty of Materials Science and Engineering, Wołoska 141, 02-507 Warsaw, Poland*
[b] *Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory of Mechanics of Materials and Nanostructures, CH-3602 Thun, Feuerwerkerstrasse 39, Switzerland*
[a]*wiktor.bednarczyk@pw.edu.pl; wbednarcz@gmail.com*

Zn alloys are promising novel biodegradable materials for biomedical applications. Nowadays, the highest effort is given to the improvement of mechanical properties. Besides a chemical composition, grain refinement is a major strengthening method applicable in Zn alloys. Thus, severe plastic deformation tends to be the most effective method to obtain high-strength, fine-grained materials. Nevertheless, the small grain size in Zn alloys results in a high tendency to grain boundary sliding (GBS) due to low melting temperature [1]. For the first time in Zn alloys, the present research combines rapid solidification and subsequent high-pressure torsion to obtain well-dispersed nanometric second phases within the ultrafine-grained microstructure. As a result, the final microstructure will exhibit high strength and resistance to GBS due to Hall-Petch and second phase pinning effects, respectively. Besides, conventional casting and subsequent plastic deformation do not crush second-phase particles even after severe plastic deformation [2].

Keywords: zinc; ultrafine-grained materials; rapid solidification; high-pressure torsion;

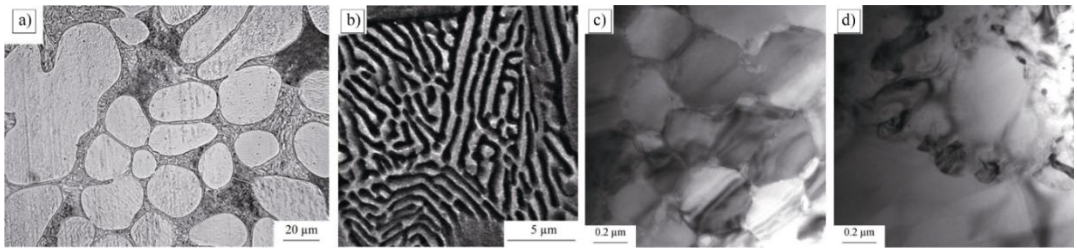

Fig.1 Microstructure of Zn-1.6Mg alloy a, b) in the as-cast state (SEM), c, d) melt-spun (TEM).

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