Study of the powder metallurgy technique to obtain magnesium alloys

Viviane do Socorro da Costa[1], Persio Mozart Pinto[1], André Luiz Carvalho de Rezende Silva[1], Durval Rodrigues Jr.[1]

[1]Escola de Engenharia de Lorena - USP (*DEMAR*)

e-mail: vivianecosta@usp.br

Biodegradable materials are gradually solvable, absorbed or excreted in human body. They have been developed to avoid a posterior removal surgery, decreasing considerably patient recovery time and its aftermath [1]. In this panorama, magnesium alloys arise as a choice for bone function restoration due to their properties, such as suitable degradation rate, biocompatibility and Young modulus (41–45 GPa) similar to the bone (3–20 GPa) [2]. These features can be achieved choosing alloying elements of essentials minerals to human body – Zn is recommended for mechanical purposes, and Sr promotes hydroxyapatite formation in the fracture site. Normally, the Zn daily consumption of an average person is 8-11 mg [2], with Sr standing as a trace metal in the human body [3]. In this work we study mechanical alloying through high-energy milling of Mg-Zn-Sr system. Milling factors of pure Mg, Zn, Sr commercial powders such as mill type, milling time, ball-to-powder ratio, and PCA (Process Controlling Agent) fraction are investigated. Then, pressing and sintering parameters for implant production will be settled, based on analysis results of x-ray diffraction (XRD), scanning electron microscopy (SEM), and microhardness. The results will be discussed based on the application of the alloy for biomedical implants. These results will be used for later Mg-alloys studies.

Acknowledgements: The authors wish to acknowledge FAPESP, CNPq and CAPES, Brazil, for the financial support.

[1] G. Song, 49, 1696–1701, (2007).

[2] Y. Chen, Z. Xu, C. Smith, J. Sankar, 10, 4561–4573, (2014).

[3] X.N. Gu, X.H. Xie, N. Li, Y.F. Zheng, L. Qin, 8, 2360–2374, (2012).