25. MEDNARODNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

16.–19. oktober 2017, Portorož, Slovenija

25th INTERNATIONAL CONFERENCE ON MATERIALS AND TECHNOLOGY

16–19 October 2017, Portorož, Slovenia

PROGRAM IN KNJIGA POVZETKOV

PROGRAM AND BOOK OF ABSTRACTS

TiZrNbTaFe High Entropy Alloy for Medical Applications

Gabriela Popescu, Brandusa Ghiban, Cristian Popescu, Robert Bololoi

University POLITEHNICA of Bucharest, Splaiul Independentei 313, 060042, Bucharest, Romania
E-mail: gabriela.popescu@upb.ro

The paper considers for the first time a new concept of alloy with high entropy (HEA) for biomedical applications. HEAs are different from the conventional metallic materials by more than five alloying elements, in proportions between 5% and 35% at., which may form simple solid solutions with BCC and/or FCC phases instead of complicated intermetallic ones. These specific features provides HEA with excellent mechanical properties (hardness, strength, malleability), oxidation and corrosion resistance, with potential applications in diverse industrial areas [1-4]. The present tendency in the newest titanium alloys generation is the decrease of elasticity modulus, with the maintaining of high mechanical characteristics [5-7]. M.C.Gao studied TiZrCuNiFe, TiZrCuNiBe, and TiCuNiSnBeZr [4,8] for various technological applications.

Thus, the paper considers the system TiZrNbTaFe for biomedical applications obtained by powder metallurgy (PM) route, because HEAs prepared by PM often show a greater homogeneity in their microstructure compared to the segregated microstructure of melted and cast HEAs. The influence of processing parameters on the microstructure and mechanical properties of the new TiZrNbTaFe alloy were investigated. The final properties of the HEAs could be: modulus of elasticity E < 80GPa, density <7g/cm^3, fracture strength >700 MPA, corrosion resistance < 0,001 mm/an. In addition, the mechanical properties of the high entropy alloy could be improved by sintering at 1250^{0}C for 2 h. The sintered HEA possesses a lower Young's modulus (about 65 GPa), moderate strength, which shows better mechanical biocompatibility in order to be used as orthopedic implants and to avoid stress shielding and thus prevent bone resorption and implant failure. The mechanical properties of the obtained alloys are better than those of pure Ti and Ti–6Al–4V.

[1] J.-W. Yeh, S.-K. Chen, S.-J. Lin, J.-Y. Gan, T.-S. Chin, T.-T. Shun, C.-H. Tsau, S.-Y. Chang, *Advanced Engineering Materials*, **2004**, vol.6, 299-303.
[2] Ming-Hung Tsai, Jien-Wei Yeh, *Materials Research Letters*, **2014**, vol.2 (3), 107–123.
[3] B.S.Murty, J.W.Yeh, S.Ranganathan, High-Entropy Alloys, *Elsevier*, ISBN: 978-0-12-800251-3.
[4] M.C.Gao, J.W.Yeh, P.K.Liaw, Y.Zhang, High-Entropy Alloys: Fundamentals and Applications, *Springer,* **2016**, ISBN: 978-3-319-27011-1.
[5] F.Otto, Y.Yang, H.Bei, E.P.George, *Acta Materialia*, **2013**, vol.61, 2628-2638.
[6] B. Cantor, I.T.H.Chang, P.Knight, A.J.B.Vincent, *Materials Science Engineering,* **2004**, vol.A375–377, 213–218.
[7] Wei Ji, Weimin Wang, Hao Wang, Jinyong Zhang, Yucheng Wang, Fan Zhang, Zhengyi Fu, *Intermetallics,* **2015**, vol. 56, 24-27.
[8] S.Y.Chang, S.Y.Lin, Y.C.Huang, C.L.Wu, *Surface Coating Technololgy*, **2010**, vol. 204, 3307–3314.