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Ti-Si alloys – Materials for implants applications

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With an increasingly aging population and improvement of living standards, there is a rising demand for new biomaterials to replace or repair structural (load-bearing) components of the human body. Nowadays, Ti and its alloys are commonly used for implant devices that replace patient's hard tissues. However, these implants are composed from harmful elements like Al, Mn, Cr, V, Co, Ni etc. From our point of view is therefore necessary to develop a low-density alloy with a high hardness that will be biocompatible and cost-effective. We focus on preparation and characterization of a Ti-Si alloys. Both Ti and Si are biocompatible elements and additionally Si supports bone calcification. We prepared five types Ti-Si

alloys. Only one alloy from five is composed of one sole phase Ti₅Si₃ alloy. Microstructure was examined by synchrotron X-ray diffraction and high resolution transmission electron microscopy. This alloy is almost 300% harder compared the implants used today. Mass density of the alloy is 4.27 g/cm³, while modulus of elasticity is 187 GPa. All prepared Ti-Si alloys are biocompatible measured in respect to MC3T3E1 mouse preosteoblastic cells. In the talk I will present preparation, phase composition, microstructure morphology, biocompatibility and basics mechanical properties of five different Ti-Si alloys.

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