

主 論 文 要 旨

論文題名

Study on fabrication and mechanical properties of
harmonic-structure designed pure titanium and Ti-6Al-4V alloys

ふりがな たつや せきぐち
氏名 Tatsuya Sekiguchi

主論文要旨

Metallic materials have a peculiar feature that their mechanical properties can be improved by controlling the microstructure. In the recent years, the demand for metallic materials with tailored properties has tremendously increased due to the requirement of materials for saving energy, resources and environment. Grain refinement is one of the important methods for improving mechanical properties. Recently, the severe plastic deformation process has received much attention, as it incorporates the grain refinement in the metallic materials very efficiently. Metallic materials with homogeneous ultra-fine grained microstructure pose a serious problem, i.e. the ultra-fine grain materials indicate quite high strength but have limited ductility due to their plastic instability. In the present research, we suggest a new microstructure design, i.e. “Harmonic structure”, which has heterogeneous microstructure but macroscopic structure is systematically arranged.

The aim of this research is to fabricate the harmonic structured titanium compacts with high strength and high elongation, and to investigate the microstructure and mechanical properties of the harmonic structured compacts. The harmonic structured compacts were fabricated by SPD (Severe Plastic Deformation)-PM (Powder Metallurgy) processes from pure titanium and Ti-6Al-4V alloy powders. The microstructure and mechanical properties of harmonic structured materials were investigated. The deformation behavior of the harmonic structured compacts was also investigated and discussed.

This paper comprises of 6 chapters. Chapter 1 describes the background containing a brief description of the study of the grain refinement by SPD processes. Chapter 2 shows the experimental procedure of this research. Chapter 3 deals with the microstructure of harmonic structured Pure Ti compacts. Chapter 4 describes the microstructure of harmonic structured Ti-6Al-4V compacts. Chapter 5 is related with the mechanical properties of harmonic compacts. In this chapter, the investigation and consideration of deformation behavior of harmonic compacts are described. Chapter 6, which is the final chapter, presents the summary of these harmonic compacts and future vision.