

**Shuji Hanada**

## **Fabrication of an advanced hip prosthetic stem using $\beta$ Ti-33.6Nb-4Sn alloy**

*This study used severe cold rolling followed by cold swaging of  $\beta$  Ti-33.6%Nb-4%Sn rods to form a characteristic fiber structure composed of stress-induced  $\alpha''$  martensite with  $\langle 010 \rangle$  texture and a  $\beta$  phase with  $\langle 101 \rangle$  texture, resulting in a material with a low Young's modulus of 40 GPa. The high tensile strength of 1270 MPa and fatigue strength of 850 MPa were attained by heat treatment at 673 K for 5 h through fine  $\alpha$  precipitation in the fiber structure. A new method of fabricating a high-performance hip prosthetic stem was investigated based on the low Young's modulus and high strength obtained. After fabricating the stem by cold rolling, cold swaging, cold die-forging and machining, its neck region was given higher strength through local heat treatment, while the low Young's modulus remained almost unchanged in a distal portion of the stem. When a stem tip in the distal part was heat treated at 423 K, reverse  $\alpha'' \rightarrow \beta$  transformation occurred and the tangent modulus decreased to less than 30 GPa, accompanied by stress-induced  $\beta \rightarrow \alpha''$ . It was concluded that the method presented herein provided a low Young's modulus of approximately 40 GPa in the distal part and high fatigue strength of approximately 850 MPa in the neck region of a high-performance hip prosthetic stem.*

El Prof. Shuji Hanada es Emérito en el Institute of Materials Research (IMR) de la Universidad de Tohoku (Japón). Durante muchos años el Prof. Hanada ha trabajado en materiales Intermetálicos y Refractarios para aplicaciones estructurales a través del control de la microestructura mediante la utilización de técnicas novedosas. En los últimos años, su trabajo se ha centrado en el estudio de aleaciones de titanio para aplicaciones biomédicas.



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