# Dynamic phase transformation driven microstructure and texture development during deformation of Zr-2.5wt.%Nb in $\alpha$+$\beta$ phase field


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**Abstract**

This work demonstrates and explains how, during the hot deformation of a Zr alloy in the two-phase field, the texture developed in the $\alpha$ phase is influenced by that developed in the $\beta$ phase. For this Zr-2.5wt.%Nb alloy was hot compressed in the $\alpha$+$\beta$ phase field (700, 750 and 800 ◦C) at 0.1 s-1 to a true strain of 1.1. The microstructure and texture were characterized using scanning electron microscopy and electron backscatter diffraction. The flow curves showed a sharp drop in flow stress at $\epsilon \approx 0.01$ due to plastic deformation induced $\alpha$ to $\beta$ phase transformation. At 700 ◦C, $\alpha$-Zr developed parallel to compression axis (——CA) (as is commonly observed in $\alpha$-Zr system), whereas at 750 and 800 ◦C ——CA formed. At all studied temperatures, $\beta$-Zr developed {001} and {111} texture components that were shown to be dependent on the elongated morphology of the $\alpha$-Zr grains and not on the $\alpha$-Zr texture. From experimental observations and thermodynamic calculations of the free energy changes in absence and presence of stress, it was shown that the formation of ——CA in $\alpha$-Zr occurred by migration of $\beta$-Zr into of $\alpha$-Zr followed by the reverse $\beta$ to $\alpha$ transformation (through Burgers orientation relationship) driven by low flow stress in of $\alpha$-Zr and low Nb content in the transforming $\beta$-Zr. It was concluded that the presence of $\beta$-Zr with ——CA and ——CA is a necessary condition for the formation of ——CA in $\alpha$-Zr. In addition, temperature promotes the development of in $\alpha$-Zr through enhanced boundary mobility of $\beta$-Zr into harder $\alpha$-Zr.



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