Anisotropic deformation behavior of a commercial purity titanium with a sharp texture

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Abstract

Commercially pure titanium (CP-Ti) was subjected to cold rolling, followed by recrystallization annealing. The thermomechanically treated sheet had equiaxed grains with an average grain size of approximately 12 μm, and a sharp texture developed in the sheet, in which the basal plane normal (< 0001>) accumulated in the direction inclined toward the transverse direction (TD) of the sheet to approximately 40 ◦from the normal direction, and the prismatic plane normal (< 1010>) accumulated along the rolling direction (RD). Tensile tests were performed along the RD and TD; the 0.2% proof stress was almost the same along both directions, but the work hardening ratio was greater along the RD, resulting in higher tensile strength and elongation at failure attained along the RD. In addition to the activities of the slip systems (prismatic and pyramidal), {11-22}< -11-2-3> compression twins were activated during tensile deformation along the RD. In contrast, the {10-12}< -1011> tension twins were activated along the TD. The difference in twinning activities depending on the tensile direction was reasonably explained by the difference in the direction of the shear strain produced by the activity of each twinning system. Regardless of the tensile direction, the Schmidt factor for the slip in the compression twins was relatively low, whereas that for the slip was high. Contraly to this, the Schmidt factors for both slip systems were high in tensile twins. It was concluded that the anisotropic deformation behavior of the present CP-Ti sheet was due to the difference in the activated twinning system depending on the tensile direction.

Keywords: Commertial purity titanium, anisotropic deformation, mechanical twinning

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