Transformation of rolling to basal texture in CP-Ti processed by step cold-rolling plus recrystallization annealing

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Abstract

After sheet forming, the commercially pure Ti (CP-Ti) sheets are always characterized by a rolling texture with the **c**-axis of the most of the grains oriented at 45◦ to 90◦ from the normal direction (**ND**) towards the transverse direction (**TD**) (1), provoking anisotropic response when such sheets are further subjected to deformation and thus resulting in geometric defects or failure. A Basal texture is ideal to reverse the anisotropic behaviour to the planar isotropic performance. Thus, in this work we designed a processing strategy with 7 steps of cold-rolling + recrystallization annealing to a Grade 2 CP-Ti to transform the initial rolling texture to the desired Basal texture. The rolling was performed along either the initial rolling direction (**RD**) (**RD**-rolling) or the transverse direction (**TD**) (**TD**-rolling) with step thickness reduction of 20%. After each step of rolling the recrystallization annealing was conducted at 720◦C for 1h. Further microstructure and crystallographic analyses showed that the texture transformation to Basal texture during rolling was mainly realized by the {10-12} extension (T1) twinning. The subsequent recrystallization annealing further favors the grains with Basal orientation to preferentially recrystallized and grow. The activation of twinning during rolling is uniquely possible when the external load can be positively resolved in the twinning direction on the twinning plane. When the strain provided by twinning is compatible with the macroscopic rolling strains, which is the case of **TD**-rolling, the active twinning becomes intensive. In the strain compatible condition, matrix grain can be totally twinned off. Thus, at the beginning, the **TD** rolling was more efficient in producing the Basal orientation through intensive T1 twinning. After the 7 steps, the Basal texture was successfully achieved by both routes.

References

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