Recrystallization nucleation mechanism of cold-rolled texture pure Titanium with electric-pulse treatment

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Abstract

Abstract The recrystallization nucleation behavior and its mechanism of cold-rolled texture pure Titanium with or without the electric-pulse treatment were investigated. Both the scanning electron microscope with an electron backscatter diffraction (EBSD) and transmission electron microscope (TEM) techniques are carried out for analyzing the microstructural evolution of the cold-rolled texture Titanium during the annealing treatment, especially at the initial stage of recrystallization processing in detail. The results shown a homogenous distribution of nucleation formed in the cold-rolled texture Titanium specimen, while oriented nucleation occurred in the electric-pulse treatment specimen. Most of the recrystallized grains was found in $< 0001>$ poles tilted about 20$\circ$ away from the normal direction. The pyramidal dislocation slip can be confirmed to be the predominant slip system in the deformed grains with the $< 0001>$ pole distribution. For the grains with other orientations, prismatic dislocations slips were mainly activated. It can be believed that thus type of the activated dislocations rather than stored strain energy governed the preferential sites for nucleation. The pyramidal dislocation slip is considered as an essential for the formation of sub-grain boundary. While, the active climb of pyramidal dislocation is depended on the high content of vacancy around them. The oriented nucleation in the electric-pulse treatment specimen could be attributed to the enlarged activity difference of climb between pyramidal dislocation and prismatic dislocation treated with electric-pulse.

Keywords: recrystallization, oriented nucleation, pure Titanium, electric, pulse

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