8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)

14–17 October 2016

Seattle, Washington | Hosted by Purdue University

SESSION 3: DEFORMING AND RECRYSTALLIZATION, SALON C

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SATURDAY, OCTOBER 15, 2016

Thermal simulation method for following microstructures evolution during stress relaxation in deformed Fe–40Ni–Ti alloy

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ABSTRACT

The stacking fault energy of Fe–40Ni alloy has similar values to that of the austenite in steels at wide temperatures; and furthermore, the Fe–40Ni alloy can keep face-centered cubic structure (fcc) at the room temperature. In the present works, the thermo-simulation test, metallographic observation, and transmission electron microscopy (TEM) were applied to investigate the stress relaxation curves, microstructures evolution, and dislocation configuration behavior during relaxation at 850°C in deformed Fe–40Ni alloy with micro-addition Ti element. The experimental results indicate that the stress value of tested alloy is higher than that of the Ti-free simulation alloy during the whole relaxation process. When the relaxing time reaches 200 s, the recrystallization occurs in the samples. A large numbers of micro-grains of recrystallization can be observed around the original grains for 1000 s. At the same time, the twisted dislocations formed during the deformation develop into polygon structures; and finally, the perfect dislocation cells can be found when the samples relaxing to 1000 s. The undissolved precipitates of TiN retards the progress of recrystallization to some extent.

KEYWORDS: thermo-simulation test, Fe–40Ni–Ti alloy, relaxation, microstructures evolution, dislocation configuration