Formation of annealing twins during primary recrystallization of two low stacking fault energy Ni-based alloys

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First stages of recrystallization are analyzed in low stacking fault energy nickel alloys cold rolled and subsequently annealed at 700°C for 6 minutes. These alloys are envisaged as candidate materials for the heat exchanger of VHTR (Very High Temperature Reactor) that works at 1000°C. First recrystallized grains show evidence of extensive twinning that is studied by Transmission Electron Microscopy. Specific twinning features such as five-fold twin and microtwins bordered by partial dislocations are revealed. Twin density increases with increasing amounts of prior deformation before annealing. The local crystal orientations are determined at a nanometer scale. It is shown directly that when twinning occurs, the recrystallized area beyond the twin has a lower stored deformation energy. Thus recrystallization and the associate twinning induce a decrease in the total stored deformation energy.