Phase Transformation of CoCrFeMnNi High Entropy Alloy under High Pressure Influenced by Initial Defects

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Conventional alloys typically consist of one or two principal component elements, to which small quantities of various alloying elements are added. In contrary, High-entropy alloys (HEAs) is composed of five or more near-equiatomic elements that exhibit better mechanical characteristics than conventional alloys. In transition metal HEAs, which exhibit either face-center cubic (fcc) or body-center cubic (bcc) crystal structure in ambient environment. For example, in CoCrFeMnNi HEA, the fcc phase is its typical stable phase in ambient environment. In recent years, the hexagonal closed-packed (hcp) phase of CoCrFeMnNi HEA had been synthesized under high pressure, and a large portion of hcp phase can be persisted after the decompression to ambient pressure. However, it is worthy to be mentioned that the fcc-to-hcp transformation ratio of the CoCrFeMnNi HEA is different among works.

In this work, we compared two CoCrFeMnNi HEAs materials with different mechanical machining, including 0% cool rolling (as-cast, less defects) and 70% cool rolling (more defects) specimens, to study that how internal defects can influence fcc-to-hcp transition in CoCrFeMnNi HEAs. The in-situ high-pressure synthesis experiment was performed at BL01C1 X-ray diffraction beamline of National Synchrotron Radiation Research Center. The crystal structural variations and phase transition can be analyzed during compression and decompression processes by the high-resolution synchrotron XRD patterns. We found that the phase transformation ratio of cool rolling 0% (as-cast) and cool rolling 70% are 70% and 90%, respectively, that might influenced by different initial defect conditions.

Keywords: CoCrFeMnNi, High-entropy alloys, fcc-to-hcp transition