GRADUATE STUDENT RESEARCH SEMINAR SERIES (2020)

EFFECT OF PHASE DECOMPOSITION ON THE STRENGTH OF COCRFEMNNI HIGH-ENTROPY ALLOY

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Though the mechanical behavior of CoCrFeMnNi “Cantor” alloy is well understood, the magnitude of mechanical degradation after phase decomposition has not been studied in this material. The Cantor is a single-phase, high-entropy alloy (HEA) that was originally believed to be a thermodynamically stable solid solution. After prolonged aging, the single phase decomposes into intermetallic particles (L10-MnNi, B2-FeCo) and the Cr-rich sigma (σ) phase. These are commonly associated with material degradation, including loss of ductility and premature fracture. Specimens in the present study were aged for 30 days at 700°C to observe precipitation of the σ phase, and a second set of specimens were aged 15 days at 610°C to observe precipitation of intermetallic compounds. The specimen microstructures were analyzed for secondary phases using electron backscatter diffraction (EBSD) and energy-dispersive spectroscopy (EDS). Microhardness experimentation was employed as a quick method to determine the occurrence of any precipitation via heat treating. Uniaxial, quasi-static, room temperature tensile experiments at a strain rate of 1 x 10-4 were used in conjunction with digital image correlation (DIC) to determine the mechanical behavior of the aged specimens.

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