Crystal structure investigation of ferritic 73fe24cr2si0.8mn0.1ni steel for multi-purpose structural material applications

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Abstrak

Microstructural identification of synthesized steel with significant local content has been carried out. Alloy ingot was prepared using a casting technique. The samples were then formed into bulk steel by a machining process. A high resolution powder neutron diffractometer (HRPD) was used as an equipment for characterization. By applying neutron diffraction techniques, a ferritic steel profile can be resulted in as well as ‘minor peaks’ belong to impurities formed in the sample. These impurities can be identified as small amounts of Al2O3 54SiO2, Al4C3, SiC and Cr23C6. Scanning transmission electron microscopy (STEM) combined with energy dispersive X-ray spectroscopy (EDX) confirmed and revealed neutron identified phase distributions. Joint Committee on Powder Diffraction Standards (JCPDS) least square curves calibration can precisely calculate the dhkl parameters of each reflection plane. As a comparison, another sample of alloy ingot was also investigated using neutron diffraction. The pattern was free from crystal impurities. Rietveld refinements provide satisfactory goodness of fits Rwp = 10.42% and reliability factor S = 1.7. This was so-called a ‘real bulky’ sample of a 73Fe24Cr2Si0.8Mn0.1Ni ferritic steel alloy.