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Temper embrittlement of 9%Ni low carbon steel

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Abstract: This study investigates the correlation between the microstructure and fracture characteristics of a 9% Ni low carbon steel tempered at 400 °C. This material is used in cryogenic services in oil and gas industries. The un-correct tempering temperature selection may cause temper embrittlement (TE), which drastically decreases the cryogenic toughness of the steel. This phenomena was investigated in specimens with fine and coarse previous austenite grains. The fracture surfaces of temper embrittled specimens were characterized by intergranular cracks and quasi-cleavage facets. Fe₃C intergranular particles were found to be the main microstructural evidence and the cause of temper embrittlement in the 9%Ni low carbon investigated, as observed by detailed scanning electron microscopy with elemental microanalysis.