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EFFECT OF PWHT ON THE TOUGHNESS OF MODIFIED 9CR-1MO STEEL WELDMETAL

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Abstract

Modified 9Cr-1Mo steel is extensively used for high temperature applications due to its good thermo-physical, weldability, fabricability and high temperature properties. While Type IV cracking is of concern during service of weld joints, toughness of its weldmetal is an important consideration during qualification of weld joints, especially for those made by SMAW process. The weldmetal toughness is significantly influenced by deposition process and sequence, and temperature and duration of PWHT. For a special-purpose mod.9Cr-1Mo steel weldmetal, containing intentional addition of 2.4wt% of nickel and manganese, the A and A transformation temperatures, calculated using ThermoCalc software, was found as 945 and 1065K, respectively. To understand its tempering behavior, the weldmetal was subjected to PWHT at 1013, 1033 and 1053K for different durations. The weldmetal hardness decreased significantly on PWHT at 1013K compared to that at 1033 and 1053K. The weldmetal toughness increased monotonically with PWHT temperature; from 27J for 923K PWHT to 32J and 132J for 973K and 1023K PWHTs, respectively, and then decreased marginally to 113J on PWHT at 1153K. These results suggested formation of fresh martensite during PWHT at 1053K. Bright-field transmission electron microscopic examination revealed formation of lath martensite in the weldmetal, with the lath sizes being finer than those reported in other mod. 9Cr-1Mo steel weldmetal prepared using similar process. Hence, detailed microstructural analyses was carried out to investigate this anomalous variation in mechanical properties, as also to study the effect of temperature and duration of PWHT on the microstructure and toughness of this modified 9Cr-1Mo steel weldmetal.

ON THE EFFECTIVENESS OF DUPLEX STAINLESS STEEL CLADDING DEPOSITED BY GAS METAL ARC WELDING

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Abstract

Parts of a mechanical system or structure operating, or located, in corrosive environment get corroded gradually, and after a period of operation, it may fail prematurely, thus increasing cost of servicing and maintenance. There are various solutions which can be used to protect components or structures from the detrimental effect of their surrounding environment. Metal cladding is one of the solutions which are used widely and is economical. In the present experimental investigation, duplex stainless steel electrode is taken for cladding employing gas metal arc welding process. Tests are carried out on low alloy steel plates under different parametric combinations. Metallographic study and corrosion test are performed to evaluate changes in microstructure and corrosion behaviour of the clad portion respectively. At a welding voltage of 28 V, weld current of 145 A, and weld speed of 516 mm/min, when heat input is 0.38 kJ/mm, corrosion rate is found to be minimum. Hence, this parameter combination may be recommended for cladding to obtain more service life of components under similar corrosive environment.