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Effect of CaF_2, FeMn and NiO additions on impact strength and hardness in submerged arc welding using developed agglomerated fluxes

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Abstract

This experimental study was conducted to evaluate the effects of CaF_2, FeMn and NiO additives on impact strength and hardness of low carbon steel plate welds using submerged arc welding. Fluxes containing CaO, SiO_2 and Al_2O_3 as base fluxes were designed and developed through agglomeration technique. CaF_2, FeMn and NiO were added to these fluxes in the varying amounts of (2-8) %. Mathematical models were developed using design expert and these models were correlated with the Mn ,Ni and C transfer to the bead. The mechanical properties also have been correlated with the microstructure developed and the oxygen content in the welds. CaF_2 and FeMn are found significant factors for the impact strength while the interaction of CaF_2 and NiO is significant for hardness of the weld. The optimum ranges for Mn and Ni contents that produce optimum impact strength and hardness also have been suggested. The basicity index of flux and the carbon equivalent of the welds also have been correlated with the mechanical properties of the welds. The impact strength was found minimum for those welds which were welded by having CaF_2, FeMn and NiO each at mid-level of 5%, though the Δ Mn quantities for these welds were low.

Keywords: Submerged arc welding, basicity index, element transfer, acicular ferrite, impact strength, delta Mn quantity

Introduction

Submerged arc welds of high strength and toughness can be obtained by proper selection of flux, wire and welding parameters for a specific base metal. Small amounts of alloying elements such as Mn, Si,

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