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SOME ISSUES ON EDUCATION, TRAINING AND SKILLING OF WELDING PERSONNEL IN INDIA

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Abstract

India is a fast developing country with large population having huge potential for fast growth. Welding is extensively used in India in various industrial sectors such as railways, automotive, ship building, off-shore structures, pipes and vessels, construction, nuclear power plants, and energy. India's road network is the third largest and its rail network is the fourth largest in the world. Fabrication by welding has a major role in the infrastructure growth and the manufacturing sector including welding contributes to 15% to GDP growth in India.

Welding has been in practice in India since time immemorial. Industries, educational institutions and research organizations have been contributing to the development of welding science and technology in the country. While many industries are using state of art technologies, the breakup of the share of welding processes in fabrication and joining in India is roughly: SMAW 75%, GMAW plus GTAW 15%, SAW 3%, other fusion welding processes 3% and solid phase welding 4%. Over a million personnel are engaged in welding-related activities in India. They are engaged in development of consumables, manufacture of welding equipment and accessories, fabrication including repair and maintenance, development of welding automation and simulators, R&D in welding, and education and training in welding.

There are about 4 lakh welders working in organized and unorganized sectors in the country – majority (about 70%) of them are in the unorganized sector. Training and retraining of welders of such large number is indeed a daunting task. Vocational schools, Industrial Training Centres, Training Institutes and industrial houses provide training and certification to welders. Several educational institutions including degree and diploma colleges train welding engineers and supervisors. IIW-India also conducts AMIIW examination to certify qualified engineers and also facilitates issue of various certificates like International Welder, International Welding Engineer, etc.

The facilities available for educating, training and skilling of welding personnel in India seem to be inadequate. There seems to exist a huge gap between the projected demand and the supply. The gap can only be narrowed down if Distance Mode of Education with appropriate technologies such as Welding Training Simulators can be resorted to. The Government of India and several private organizations are taking various initiatives to rise to the occasion raising the hope of a bright future ahead.

INFLUENCE OF BORON AND NITROGEN ON THE HEAT AFFECTED ZONE OF MODIFIED 9CR-1MO STEEL: GLEEBLE SIMULATION STUDY

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Abstract

Boron is reported to improve Type IV cracking resistance of 9Cr-3W-3Co-V-Nb steel, with this improvement being attributed to the presence of uniform microstructure in the heat affected zone (HAZ) and its thermal stability during high temperature service. Similar results have been observed recently in modified 9Cr-1Mo steel; hence, the present work aims to understand the role of boron and nitrogen in the microstructural evolution of the HAZ in this steel. For this purpose, using a Gleeble thermal-mechanical simulator, HAZ microstructures were simulated in normalized (1100°C/1h) and tempered (760°C/3h) modified 9Cr-1Mo steels with different boron and nitrogen contents. The Gleeble simulation was carried out by subjecting the specimens to heating cycle at different peak temperatures in the range 875 to 1200°C using a heating rate of 45°C.s^{-1}. The effect of heating rate on the transformation temperatures was also studied using dilatometry. The simulated HAZ specimens were characterized using optical and scanning electron microscope, x-ray diffraction (XRD) and hardness measurements.

Microstructural examination of the Gleeble-simulated specimens shows that typical lath martensitic structure is present in all specimens of the boron-containing steel. However, in the 910°C simulated specimens of the boron-free steel lath martensite is absent and fine prior austenite grains are present. It is also observed that hardness increases marginally with increase in peak simulation temperature in the boron-containing steel. To understand the microstructural evolution in the HAZ, the crystallite size, lattice strain and dislocation density were estimated by analysis of XRD data. While variations in crystallite size are marginal, the lattice strain and dislocation density vary with peak simulation temperature. Further detailed microstructural analyses have clearly shown the stability of microstructure in the HAZ depends on the boron and nitrogen contents in the steel. The present paper presents and discuss the results of this experimental investigation.