Effect of welding variables on mechanical properties of low carbon steel welded joint

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ABSTRACT

This paper discussed the effect of welding variables on the mechanical properties of welded 10 mm thick low carbon steel plate, welded using the Shielded Metal Arc Welding (SMAW) method. Welding current, arc voltage, welding speed and electrode diameter were the investigated welding parameters. The welded samples were cut and machined to standard configurations for tensile, impact toughness, and hardness tests. The results showed that the selected welding parameters had significant effects on the mechanical properties of the welded samples. Increases in the arc voltage and welding current resulted in increased hardness and decrease in yield strength, tensile strength and impact toughness. Increasing the welding speed from 40-66.67 mm/min caused an increase in the hardness characteristic of the welded samples. Initial decrease in tensile and yield strengths were observed which thereafter increased as the welding speed increased. An electrode diameter of 2.5 mm provided the best combination of mechanical properties when compared to the as received samples. This behaviour was attributed to the fact that increased current and voltage meant increased heat input which could create room for defect formation, thus the observed reduced mechanical properties.

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Vpliv spremenljiv pri varjenju na mehanske lastnosti zvarnih spojev na nizkoogljicnem jeklu

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POVZETEK

Članek proučuje vpliv procesnih spremenljivk pri varjenju na mehanske lastnosti 10 mm debele varjene plošče, narejene iz nizkoogljicnega jekla. Uporabili smo metodo obločnega varjenja z oplaščeno elektrodo (angl. Shielded Metal Arc Welding – SMAW). Procesne spremenljivke so bile varilni tok in napetost, hitrost varjenja in premer elektrode. Pripravili smo standardne preizkušance za natezni preizkus, preizkus udarne žilavosti in merjenje trdote. Rezultati merenj so pokazali, da imajo izbrane spremenljivke pri varjenju bistven vpliv na mehanske lastnosti varjenih vzorcev. Višja varilna napetost in večji varilni tok omogočata višjo trdoto, medtem ko so se vrednosti za mejo plastičnosti, natezno trdnost in udarno žilavost znižale. Pri povečanju hitrosti varjenja od 40 mm/min do 66.67 mm/min beležimo povečanje trdote varjenih vzorcev. Začetnemu znižanju vrednosti za natezno trdnost in mejo plastičnosti je sledilo povečanje vrednosti, ko smo povečali hitrost varjenja. Najboljše mehanske lastnosti smo ugotovili na vzorcih, ki so bili varjeni s premerom elektrod 2.5 mm. To pripisujemo dejstvu, da večje vrednosti tokov in višje napetosti pri varjenju pomenijo tudi večje vnose energije, kar lahko povzroči oblikovanje defektov v materialu, ti pa znižujejo mehanske lastnosti zvarov.

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