Effect of EBW process welding parameters on AISI304L stainless steel bead geometry

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One important field in the welding researches is the study of the relationship between the welding bead geometry and welding machine parameters. In electron beam welding (EBW) process, the fine controlled parameters enable a detail understand of the weld profile. EBW provides a concentrated beam of energy which can result in a high ratio of weld depth to bead width, which can be called a keyhole. EBW is widely study because of its importance in nuclear and aerospace application, mainly as a result of keyhole bead geometry. The relationship between the welding bead geometry, width root and depth with welding machine parameters is presented in this work by setting beam current and beam deflection frequency. All experiments were carried out on samples of AISI 304L alloy with a thickness (t) = 10 mm, accelerating voltage U = 60 KV, beam current range I = 34 - 43 mA, welding speed v = 480 mm/min, vacuum p < 10-4 mbar, beam deflection width d = 1.2 mm and beam deflection frequency f = 400 / 600 Hz. The weld joint geometry has changed by varying of beam current and beam deflection frequency. The weld penetration was increased by increment of beam current and deflection frequency. Set the frequency at f = 600 Hz and changing the beam current from 34 mA to 39 mA, it was observed that penetration rise from 7.38 mm to 8.46 mm, respectively. On the other hand, when was modified deflection frequency from 400 Hz to 600 Hz, the average welding penetration surged 6.3%. Moreover, with deflection frequency kept in f = 400 Hz, a beam current increment from I = 37 mA to I = 43 mA led to grow the welding penetration from 7.56 to 8.63, respectively. The results of weld width root showed no variation due to an increase of beam current, however applying a change of electron beam deflection frequency from 600 Hz to 400 Hz was verified a slight increase in it. In conclusion, the welding bead geometry is directly affected by varying of current beam and deflection frequency parameters.