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Effect of interlayer thickness on the microstructure and strength of WC-Co/Invar/316L steel joints prepared by fibre laser welding

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Abstract: Increasing the thickness of the Invar ($Ni_{42}Fe_{50.9}C_{0.6}Mn_{3.5}Nb_3$) interlayer from 1 to 1.5 mm resulted in a continuous metallurgical bonding, free of voids and oxide films. Invar as a pre-placed buffer also led to higher bending strength because of the stress relaxation. When the thickness was increased to 2 mm, the porosity in the fusion zone increased and cracks developed near the fusion boundary on the WC-Co side, lowering the strength. The fusion boundary, heat affected zone and the fusion zone on the WC-Co side were susceptible to cracking. Transmission electron microscopy revealed high densities of dislocations. Energy dispersive spectroscopy suggested that long-range solute diffusion occurred inside the WC grains and at the