

Plasma diagnostics in gas metal arc welding by optical emission spectroscopy

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Abstract: The plasma column in a metal inert gas welding process is investigated by optical emission spectroscopy and high-speed imaging. The concentration and repartition of iron vapours are measured and correlated with the plasma and electrode geometric configuration. Plasma temperatures and electron densities are also measured for each studied position in the plasma. The temperatures are calculated using two different methods, allowing validation of the local thermodynamic equilibrium state of the plasma. The results show a maximum temperature of 12500K in the upper part of the arc, away from the arc axis. The iron concentration reaches a maximum of 0.3% close to the anode and strongly decreases along both the vertical and radial directions. The plasma thermophysical properties, calculated from this plasma composition, are then discussed regarding the metal transfer mode.

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