Modelling magnetohydrodynamics to investigate variation of shielding gases on arc characteristics in the GTAW process

Stuart W. Campbell, Alexander M.Galloway, Norman A. McPherson, Duncan Camilleri, Daniel Micallef

***Abstract*—** Gas tungsten arc welding requires a gas shield to be present in order to protect the arc area from contamination by atmospheric gases. As a result of each gas having its own unique thermophysical properties, the shielding gas selected can have a major influence on the arc stability, welding speed, weld appearance and geometry, mechanical properties and fume generation.

Alternating shielding gases is a relatively new method of discreetly supplying two different shielding gases to the welding region in order to take advantage of the beneficial properties of each gas, as well as the inherent pulsing effects generated. As part of an ongoing process to fully evaluate the effects of this novel supply method, a computational fluid dynamics model has been generated to include the gas dependent thermodynamic and transport properties in order to evaluate the effects that an alternating gas supply has on the arc plasma. Experimental trials have also been conducted to validate the model arc profile predictions.

***Keywords*—** Alternating shielding gases, ANSYS CFX, Gas tungsten arc welding (GTAW), magnetohydrodynamics (MHD).

S. W. Campbell and A. M. Galloway are with Department of Mechanical and Aerospace Engineering, University of Strathclyde, Glasgow, UK (phone: (+44) 141 574 5076; e-mail: stuart.campbell@strath.ac.uk).

N. A. McPherson is with BAE Systems Surface Ships Limited, Glasgow, UK.

D. Camilleri and D. Micallef are with Department of Mechanical Engineering, University of Malta, Msida, Malta