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Modeling of the transport phenomena in GMAW using argon-helium mixtures. II: The metal. (English) [Zbl 1203.80013](#)

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Summary: In this Part II [for Part I, see the authors, *ibid.* 53, No. 25–26, 5707-5721 (2010; [Zbl 1203.80016](#))], the effects of shielding gas compositions on transport phenomena in the metal are reported which include the transient processes of electrode melting; droplet formation, detachment, transfer and impingement onto the workpiece; weld pool dynamics and weld bead formation. It was found from the present study that electromagnetic force, which is affected by shielding gas compositions, plays the most significant role in determining the behaviors of metal transfer. For the same welding power input, the increase of helium content in the mixture leads to the formation of larger droplets and the decrease of droplet detachment frequency. The predicted phenomena on metal transfer are consistent with the reported experimental observations. Detailed discussions about the reasons causing the very interesting and unusual transport phenomena in the metal are given.

MSC:

- 80A20 Heat and mass transfer, heat flow (MSC2010)
- 80A22 Stefan problems, phase changes, etc.
- 78A30 Electro- and magnetostatics
- 78A55 Technical applications of optics and electromagnetic theory
- 76X05 Ionized gas flow in electromagnetic fields; plasmic flow
- 80-05 Experimental work for problems pertaining to classical thermodynamics

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Keywords:

gas metal arc welding (GMAW); shielding gas; plasma arc; metal transfer

Full Text: [DOI](#)

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