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Authors: Samer J. Algodi, Adam T. Clare, Paul D. Brown

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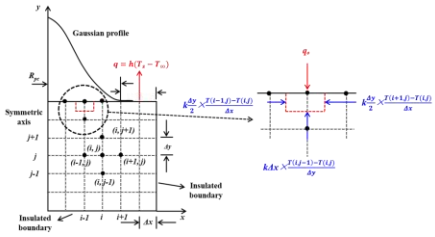
Modelling of single spark interactions during electrical discharge coating

Samer J Algodi,[a,d] Adam T Clare*[a,b], Paul D Brown[a,c]

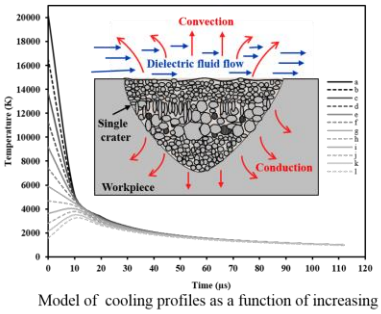
[a]Department of Mechanical, Materials and Manufacturing Engineering; [b]Institute of Advanced Manufacturing, Faculty of Engineering; [c]Nanoscale and Microscale Research Centre, University of Nottingham, University Park, Nottingham, NG7 2RD, UK; [d] Department of Mechanical Engineering, College of Engineering, Al-Nahrain University, Baghdad, Iraq

Corresponding author: adam.clare@nottingham.ac.uk

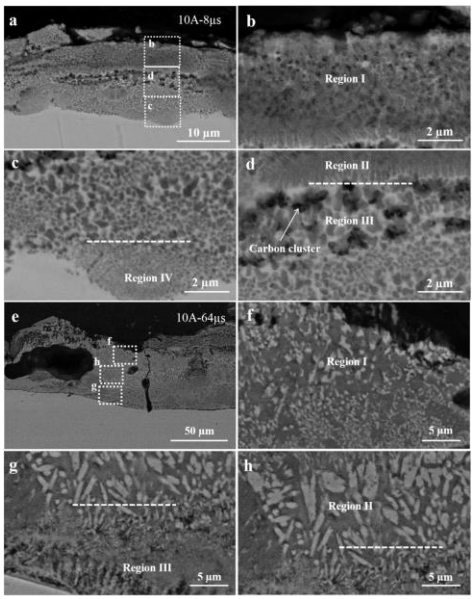
Graphical abstract



Heat source interaction and boundary conditions



Model of cooling profiles as a function of increasing time



the developed cermet coating microstructures

Abstract

Electrical discharge coating (EDC) methods may be used to enhance the surface functionality of electrical discharge machined components. However, industrial uptake of EDC has been restricted due to limited understanding of the fundamental interactions between energy source and workpiece material. The fraction of energy transferred to the workpiece, F_v, as a consequence of sparking, is an important parameter which affects directly crater geometry and the microstructural development of the near surface modified layer. In this paper, a 2D transient heat transfer model is presented using finite difference methods, validated against experimental observations, to estimate effective values for F_v as a function of processing conditions. Through this method we can predict coating layer thicknesses and microstructures through appropriate consideration of heat flow into the system. Estimates for crater depths compared well with experimentally determined values for coating layer thicknesses, which increased with the