

## Effect of Welding Parameters on Microstructure Properties of Semi-Solid Welded D2 Cold-Work Tool Steel Joints

M. N. Mohammed, Safaa N. Saud

Faculty of Information Sciences and Engineering,  
Management & Science University

M. Z. Omar, K. S. Alhawari, M. A. Abdelgnei

Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia

### Abstract

Cold-work tool steel is considered to be a non-weldable metal due to its high percentage content of carbon and alloying elements. This research investigates the joining possibilities of AISI D2 tool steel to the same material using direct partial re-melting technique. Moreover, the effect of joining parameter (temperature) on the macro-appearance, microstructure of joints were investigated. The processing temperatures for the thixojoining were 1250°C, 1275°C and 1300°C respectively for 5 minutes. Metallographic analyses along the joint interface showed that an increase in temperature promoted the final joining properties and also that at a liquid fraction of 15% joining was not fully practicable. However, a 20% liquid fraction can produce a very good joint and microstructure as compared to the other experimental liquid fraction. Metallographic analyses along the joint interface showed a smooth transition from one to the other and neither oxides nor microcracking were observed.

*Keyword:* Thixojoining, Direct partial remelting, Cold-work tool steel and JMatPro software.