Rotary friction welding of molybdenum components

Inertia rotary friction welding is an established industrial process for joining small TZM components. Now this process was used to weld tubular components of pure molybdenum.

Joining of TZM components by inertia rotary friction welding is an established industrial process, but only for welding cross-sections up to 1,500 mm². Up-scaling to medium-size components up to 5,000 mm² in a direct drive variant of the process requires further development and more basic understanding of the welding procedure including weld preforms, the clamping system, and machine parameters. Based on the existing process
for TZM tubes, the welding parameters were transferred to tubular components of pure molybdenum (Ø130x10 mm, 4,400 mm²). Successful welds were produced showing a fine-grained, defect-free microstructure. However, molybdenum proved to be more challenging than TZM. Particularly high upset rates and motor overload occurred during the friction phase. Therefore, a more mechanism based weld study was carried out with small-size samples under laboratory conditions. At the 19th Plansee Seminar Markus Stütz showed the results: extensive plasticization of the entire weld zone due to higher thermal diffusivity and lower strength of molybdenum compared to TZM. This high upset rate reduces the process window for a reproducible welding procedure significantly. Moreover, a concentrated energy input during the transition from friction to forge phase is required to countervail the high thermal diffusivity of molybdenum.

Read the full paper.

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