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Rotary friction welded C45 to 16NiCr6 steel rods: statistical optimization coupled to mechanical and microstructure approaches

Youcef Belkahla 1 & Azzeddine Mazouzi 1 & Seif El Islam Lebouachera 2 & Ammar Jabbar Hassan 3 & Martin Fides 4 & Pavol Hvizdoš4 & Billel Cheniti 5 & Djamel Miroud

Abstract: In the present work, the dissimilar joints between C45 carbon steel and nickel-chromium 16NiCr6 steel rods were produced usingrotary friction welding process. Statistical analysis based on response surface methodology (RSM), microstructural examinationusing scanning electron microscopy with backscattered electron diffraction (EBSD) and mechanical tests were performed toinvestigate the friction weld joints. The results showed that friction time and rotation speed were the most effective parameters onthe weld joint quality with the highest t-ration of ? 4.27, where the maximum bending strength of 1406.9 MPa was obtained at2000 rpm for 13 s friction time. Increasing friction time to 13 s resulted in remarkable decrease in grain size (about 35%) at theweld interface, which increased the hardness (350HV0.1) and elastic modulus (260 GPa).

Keywords : Rotary friction welding . RSM methodology . Microstructure