Thermomechanical Modelling of Direct-Drive Friction Welding Applying a Thermal Pseudo Mechanical Model for the Generation of Heat

In the present work a 2D axisymmetric thermomechanical model of the direct-drive friction welding process is developed, taking the temperature dependent shear yield stress into account in the description of the heat generation, utilizing a recent thermal pseudo mechanical model originally developed for the friction stir welding (FSW) process. The model is implemented in ABAQUS/Explicit via a subroutine. The application in this case is joining of austenitic stainless steel rods with an outer diameter of 112 mm, used for manufacturing of exhaust gas valves for large two stroke marine engines. The material properties in terms of the temperature dependent flowstress curves used both in the thermal and the mechanical constitutive description are extracted from compression tests performed between 20 °C and 1200 °C on a Gleeble 1500 thermomechanical simulator. Comparison between measured and simulated transient temperatures shows relatively good agreement and furthermore, the simulated deformations in terms of upsetting length and flashformation are also in good agreement with the observations from the experiment.