P3. The Effect Of Strain Rate On Ferrite Formation In Type 21-6-9 And 304l Stainless Steels

V.R. Davé, P.W. Hochanadel, M.J. Cola, M.B. Lyons, and D.A. Hartman, Los Alamos National Laboratory

Introduction

There has been very little work done on the effects of high strain rate on ferrite formation in austenitic stainless steels. Ferrite will form on account of adiabatic heating and flow – induced transformation, both of which will be related to the strain rate and overall stress state during processing. The limited work available also suggests that ferrite formation during hot working is more likely at strain rates in the range 10/s to 100/s and higher, and that it is more likely in torrsional deformation modes. This study attempts to use inertia friction welding as a means of investigating the effect of strain rate on ferrite formation.

Technical Approach & Results

Inertia friction welding imposes a torsional stress state and high strain rates, and is therefore potentially well-suited for this study. Tube specimens were welded at various conditions using a design of experiment matrix. In-process data such as flywheel velocity, pressure, and weld upset were recorded. The specimens were instrumented with thermocouples to measure cooling rates, and a thermal inverse model was used to estimate the cooling rate at the weld interface based on measurements taken at various distances from the original interface. Acoutic emissions from the weld were also recorded using a non-contact method as well as contact probes attched to the weld tooling. Ferrite charaterization was done using ferritescope measurements as well as microstructural characterization.

Conclusions

Inertia friction welding is a potentially useful method for investigating the effect of high strain rate on ferrite formation in austenitic stainless steels. Preliminary results to this effect are presented herein.