Preface

Friction welding can be used widely in industry because of its precision of operation, high processing speed, and low cost. Friction welding has advantages of incomplete molten state of the welded parts at the weld interface region. This is particularly important for welding of dissimilar materials, in which case narrow heat affected zone is favorable. To improve the end-product quality, care must be taken to select proper welding parameters according to the sets of materials used in the welding process. In addition, the development of high temperature gradients in a short distance across the weld interface results in high stress levels in the welded region. In some circumstances, this limits the practical applications of the welded parts, in particular for weld sizes comparable to micro/nanoscales. Although considerable research studies were carried out to minimize the welding defects, further studies need to be carried out to explore the possible application of friction welding at micro/nanoscales. This is mainly because of the complicated nature of the problem at micro/nanoscales. Since the process involves with multi-physics, development of new model studies is required to capture the physical phenomena. However, online experimentation of the welding process at micro/nano level is extremely difficult and costly because of the limitations in sensing systems, which operate at high temperatures during the friction welding process. On the other hand, the model studies of the welding process provide useful insight into the physical processes taking place during the welding and provide optimum operating parameters for sound welds.

Metallurgical and morphological changes in the welding region are important to secure sound and quality welds for the practical applications. Since metallurgical changes influence significantly mechanical properties of the weld sites, experimental assessments of mechanical properties of resulting welds become essential. Optimization of welding process, utilizing the statistical tools, improves mechanical and metallurgical properties and assists to produce desirable welds for the practical applications.

In this book, thermal analysis including thermal stress development during friction welding is formulated at macro and micro levels. Equilibrium and non-equilibrium heating situations, pertinent to friction welding, are classified and the closed-form solutions of governing heat and momentum equations are presented. Analytical solution is also extended to include two-dimensional heating situation for non-equilibrium energy transfer in the welded region. Assessment of some metallurgical changes in the weld section and mechanical properties of welded parts are included in the book. However, some cases related to modeling of friction welding are not presented in this book due to space limitations and, therefore, these cases are left for the future treatments.

http://www.springer.com/978-3-642-54606-8

Friction Welding
Thermal and Metallurgical Characteristics
Yilbas, B.S.; Sahin, A.Z.
2014, X, 71 p. 55 illus., Softcover
ISBN: 978-3-642-54606-8