MODELLING OF THERMO-MECHANICAL EFFECTS GENERATED BY FRICTION SPOT STIR WELDING PROCESS

D. Birsan, E. Scutelnicu

"Dunarea de Jos" University of Galati, Department of Manufacturing Engineering
47 Domneasca St., 800008 – Galati, Romania
Corresponding author's e-mail address: dan.birsan@ugal.ro

ABSTRACT

The paper addresses the numerical modelling of Friction Spot Stir Welding, one of the optimal processes which can successfully replace the conventional resistance spot welding and riveting techniques in performing the lightweight structures in the automotive and aerospace industries. Based on finite elements analysis, the three-dimensional model, described in this work, combines the mechanical action of the shoulder and the thermomechanical effect of the welded material. It could be an efficient tool in the prediction of temperature and stress fields generated in 6061-T4 Al alloy joint by FSSW process. The tool was considered a rigid solid and the workpiece was considered a ductile material characterized by elasticity, plasticity, and a kinetic hardening effect. The outcomes of the numerical analysis provide information on heat transfer, temperature and Cauchy stress evolution in the plunging and stirring phases of the process.

KEY WORDS: FSSW process, FEA, temperature and Cauchy stress evolution

REFERENCES

[1]. **Threadgill P L, Leonard A J, Shercliff H R, Withers P J**, *Friction stir welding of aluminium alloys*, International Materials Reviews, vol.54. no.2. March 2009. pp. 49-93.
[2] **Dubourg L.; Cao X.,** *Friction Stir Welding (FSW) at Aerospace Manufacturing Technology Centre*, NRC Institute for Aerospace Research, Canada, Challenges and Issues in Joining Emerging Materials Integrated Manufacturing Technologies Institute, AMTC-2007-0045 London, UK.
[3] **Awang M., Mucino V. H., Z. Feng, S. A. David**, *Thermo-Mechanical Modeling of Friction Stir Spot Welding (FSSW) Process: Use of an Explicit Adaptive Meshing Scheme*, Technical paper 2005-01-1251, SAE International.
[4] **Boiocchi F.**, *Friction Stir Spot Welding Applied to TP AA6061-T4 sheet metals*, Metal Working World Magazine, 15 March, 2014.
[5] **Yang X. W., Fu T., Li W. Y.**, *Friction Stir Spot Welding: A Review on Joint Macro- and Microstructure, Property, and Process Modelling*, Advances in Materials Science and Engineering, Vol. 2014, Article ID 697170, dx.doi.org/10.1155/2014/697170, 11 pag.
[6] **Birsan D., Visan D., Mircea O.**, *Numerical Simulation of Transient Temperature and Von Mises Stresses of the FSW Process,*, The Annals of "Dunarea de Jos" University of Galati, Fascicle XII, Welding Equipment and Technology, ISSN 1221–4639, Volume 21 (Year XXI), 2010.

