Finite element investigation of the elasto-plastic behavior of AA6005 using the Hansel-Spittel rheological model and the Cockcroft and Latham fracture model

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Abstract : Understanding the behavior of materials requires accurate and expensive mechanical tests at different temperatures and stresses. The current trend toward numerical simulation has become an essential engineering tool. Therefore, researchers have made efforts in this area by building mathematical models based on experimental data. These models include data regarding the actual physical behavior of the material, such as its temperature sensitivity, strain rate sensitivity, and strain sensitivity. The constitutive equations of Hensel and Spittel (H-S) [1] have been frequently used (FES), due to their ease of numerical implementation, the inclusion of stress and strain history, and the calibration of parameters from tests. The objective of this work is to determine the mechanical characteristics of the aluminum alloy (AA 6005), taking into account the effect of work hardening. This behavior is then tested using finite element analysis tools to model it. The experimental results showed that the work-hardening behavior of the alloy (AA 6005) at room temperature is similar to all quasi-static strain rates studied in this work. In addition, in the range of strain rates investigated in this study, the finite element results correlate well with the experimental results. The simulated results can be really reliable only when a good constitutive equation is employed.

Keywords : tensile test, rheological behavior Hasel-Spittel, Ductile Damage Fracture criterion