Earing Profile and Wall Thickness Prediction of a Cylindrical Cup for Dual-phase Steels Using Different Yield Criteria in FE Simulation

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Abstract. Numerical methods are an important requirement for the evaluation and analysis of sheet metal forming processes. Although the quality and development of the final component can be improved, the accuracy of the obtained numerical results depends on the most correct material behavior characterization. This paper presents a study of the earing height profile, wall thickness distribution and punch force evolution for dual-phase steel sheets, containing different amounts of martensite phase, using a deep drawing cylindrical cup test. Finite element simulations and experimental tests have been performed in order to evaluate and compare the obtained results for this kind of advanced high strength steels. The numerical simulations of the cylindrical cup test were carried out using a user subroutine in the FE code with different implemented anisotropic yield criteria, such as Hill48, Barlat 91 and CPB06. The obtained ear height evolution show a good correlation with the measured experimental anisotropy coefficients. The numerical prediction using Hill48 criterion shows a greater amplitude than the other yield criteria for different angles relative to the rolling direction when compared to the experimental points. Also, the predicted punch force evolution is not very sensitive to the selected yield criteria under this drawing operation and material, being very close to experimental data.