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Stampability study of aluminum alloys for application on automotive industry

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The automotive industry has increasingly invested in aluminum alloys research as alternative material for structural parts fabrication, with the aim of reducing weight and consequently the cars fuel consumption. However, aluminum alloys present a forming challenge, as they are usually less formable than steels. Many steel stamping papers are available in literature, although a gap was found in researches regarding aluminum alloys, especially for 6XXX series. This study aims to evaluate the use of AA 6005C aluminum alloy sheets on stamping applications, with 0.90 mm tickness, considering the influence of rolling direction and microstructure on forming behavior. Some tests will be performed to raise the material properties, including uniaxial tensile tests in three directions (0, 45º and 90º), hydraulic bulge test, Nakazima test, Energy Dispersive X-Ray Spectroscopy analysis, Scanning Electron Microscopy, and Differential Scanning Calorimetry. The data extracted from mechanical characterization tests (yield stress and coefficient of plastic anisotropy on three directions, biaxial yield stress, biaxial coefficient of anisotropy, and forming limit curve) will be used as inputs of stamping simulations on PAMSTAMP. For an accurate interpretation of the results obtained from physical and virtual stamping tests, the alloy metallurgical analysis is imperative, including microstructure, dispersion, grain size, and alloy phases. Is expected to find a correlation between stamping tests, and metallic materials yielding and hardening criterions, to sustain the prediction of the alloy forming behavior through the use of mathematical models.