The influence of microstructure on the formability of aluminium alloy sheets

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Jury:
- Pr. Joël BONNEVILLE, Professeur à l'université Poitiers, Rapporteur
- Pr. Aude SIMAR, Professeur à l'Université Catholique de Louvain, Rapporteur
- Pr. Michel PEREZ, Professeur à l'INSA Lyon, Examinateur

Abstract: As automotive manufacturers seek to improve the fuel efficiency of passenger vehicles, they look to replace current, heavy steel components with newer, lightweight aluminium (Al) alloys. Al alloys based on addition of magnesium (Mg), silicon (Si), and copper (Cu), have been shown to provide adequate strength to replace these steel components but lack the desired formability. This work aims to understand the effects of Mg, Si, and Cu, additions on the overall formability of these alloys. Through the use of differential scanning calorimetry and hardness testing, the state of the microstructure has been indirectly revealed. The use of tensile testing has permitted to determine the mechanical properties in relation with the microstructure. The mechanical properties parameters have then been included into finite element modeling simulations to understand their effects on the overall alloy formability. This thesis has achieved a connection between the composition, the changes in microstructure for two different processing routes, the resulting mechanical properties and their influence on the ultimate formability of these Al-Mg-Si-Cu alloys.