Porosity closure in aluminum alloy thick plates for aerospace

Pauline GRAVIER

Supervisors: Luc Salvo et Pierre Lhuissier
Co-supervised by Fanny Mas et Alexandre Barthelemy (Constellium Technology Center)

Thursday, December 12, 2019 p.m.
Amphitheater Jean Besson (Phelma-Campus)

Jury:
Madame Nathalie LIMODIN - Chargée de Recherche, Université de Lille, Rapporteur
Monsieur Laurent DELANNAY - Professeur, Université Catholique de Louvain, Rapporteur
Monsieur Pierre-Olivier BOUCHARD - Professeur, Mines ParisTech, Examinateur
Monsieur Thilo MORGENEYER - Maître de Recherche, Mines ParisTech, Examinateur

Abstract: Aluminum alloys are omnipresent in aerospace manufacturing thanks to their low density, their good mechanical properties and their high resistance to corrosion. However, their mechanical properties are deteriorated by the presence of pores. Those pores appear during casting and are closed during hot rolling. The present work aims at observing pores within the material during their deformation thanks to X-ray microtomography. Simulations are used to determine the local mechanical loading. It results that pore shape is of prime importance, complex branched pores close differently than spherical pores. Pore orientation also affects closure. Conversely, processing conditions such as temperature or compression velocity have a negligible influence. A simple model of pore closure is proposed and works better than existing models for complex pores deformed in compression.