Microstructure – Properties relationships for AA-2024 & AA-5086 (aluminum alloys) after long term and high-temperature aging

Louise BRIEZ
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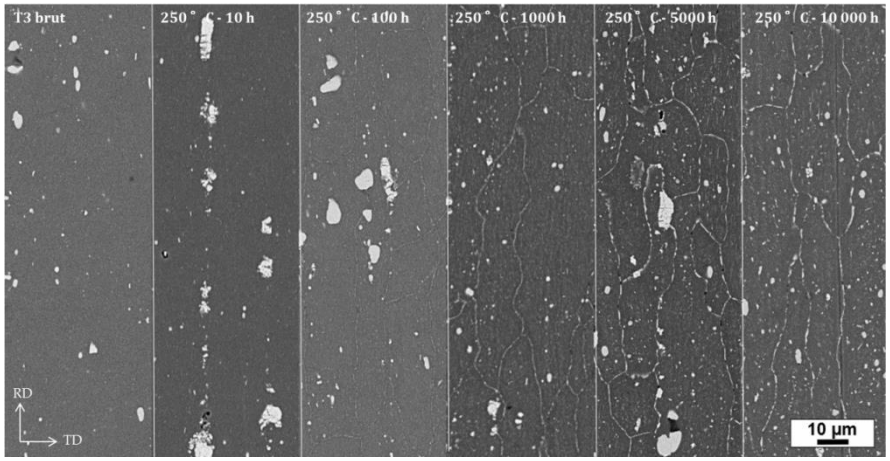
Industrial Partner: Dassault Aviation
Supervisors: J. Crépin, V.A. Esin, A. Köster



Microstructure of AA-2024 for different aging time at 250 °C (SEM)

- Aluminum alloys
- High temperature and long-term aging
- Mechanical properties
- Microstructure

Abstract:

Aluminum alloys possess low weight and cost and have a high strength which makes them one of the most used materials in aircraft industry. For example, AA-2024 (Al-Cu-Mg) is used for the wings or fuselage and AA-5086 (Al-Mg) is used for pipes and both are supposed to operate in the temperature range from – 55 to + 85 °C.

Nevertheless, different parts of aircrafts can be exposed accidentally (fire, overheating during processing) at temperature significantly higher than 85 °C. The impact of such accidents on microstructure and, especially, mechanical properties of these alloys is not well-known since the data are lacking in the literature.

Therefore, the aim of this study is to characterize the microstructure and mechanical properties evolution of AA-2024 after different times of exposure at temperatures above 85 °C.

2024 T3 and T8 and 5086 H111 alloys are artificially aged at different temperatures in the range from 85 to 250 °C for different durations varying from 1 to 10000 h. Then, tensile and hardness tests are carried out to investigate the influence of high temperature ageing on mechanical properties. The combined use of SEM, TEM and DSC allows to characterize the microstructure at different scales. The evolution of precipitation is correlated with the change of mechanical properties at different temperatures. Using the time-temperature equivalence, the prediction for microstructure would be done for the temperature range from 100 to 175 °C and for durations longer than 10000h to approach service conditions.