ESRF	**Experiment title:** Microstructure mapping of Al-Cu-Li Friction stir welds along post welding heat treatments using small angle scattering	**Experiment number**: MA959
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Names and affiliations of applicants (* indicates experimentalists):

A. Deschamps*, F. de Geuser*

SIMAP – Grenoble INP – CNRS, BP 75, 38 402 Saint Martin d'Hères Cedex, France

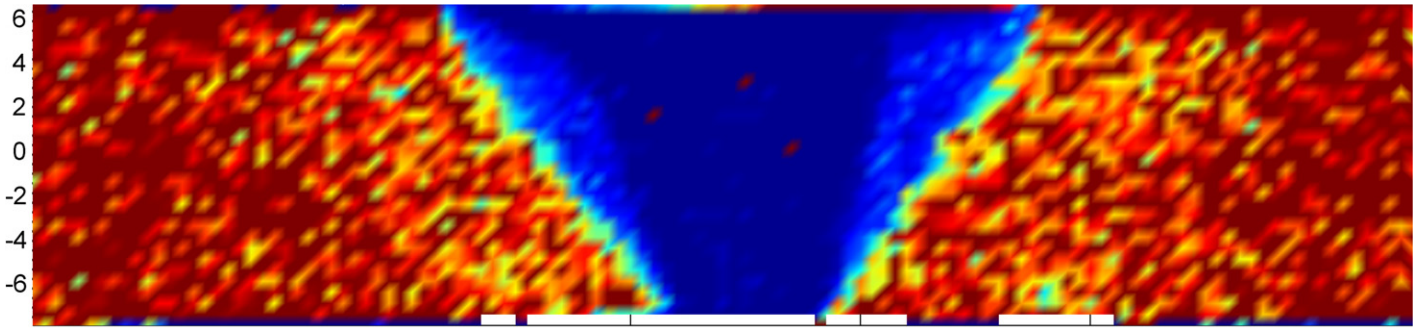
Report:

SAXS was used to map the precipitate microstructures across friction stir welds of the Al-Li-Cu alloy AA2050 used for aerospace applications. The strength of this material is essentially determined by the T1 precipitates (Al2CuLi), whose distribution is largelly affected by the combination of temperature and strain experienced during welding.
Maps have been obtained in the weld cross section, with the dimension of the complte sample thickness (20 mm) and a width of about 80mm. Each map represented several thousands SAXS acquisitions.
Different combinations of material's initial state before welding and post-welding heat treatment have been investigated :
T3 (naturally aged) + welding
T3 + welding + T8 (ageing at 155°C)
T8 + Welding

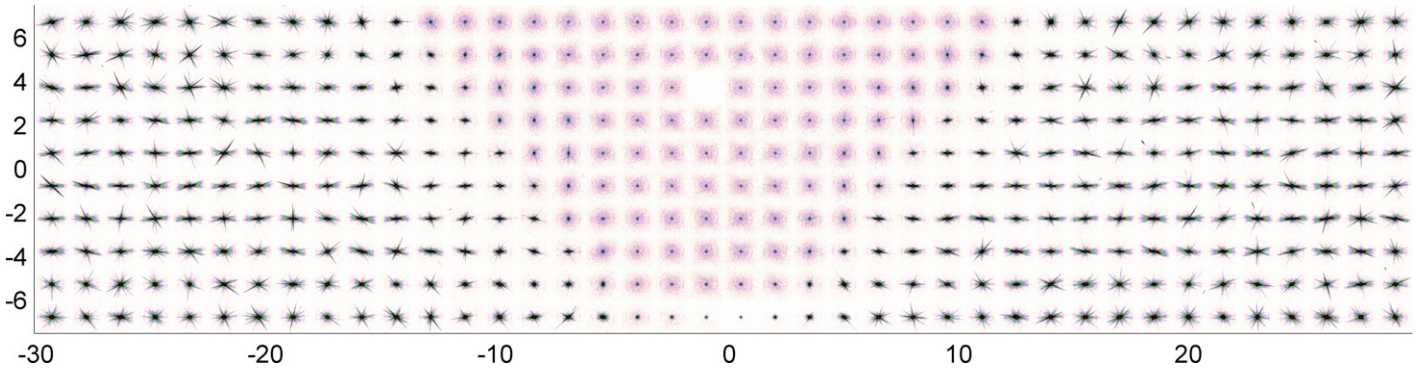
In addition, for the T3+W+T8 material, the kinetics of microstructuctrure evolution has been followed by performing line scans at specific depth under the weld surface for different ageing times during the heat treatment at 155°C.

Finally, samples subjected to model heat treatments in a salt bath have also been measured, so as to determine the characteristic temperature of the phenomena occurring in the heat affected zone of the studied welds.

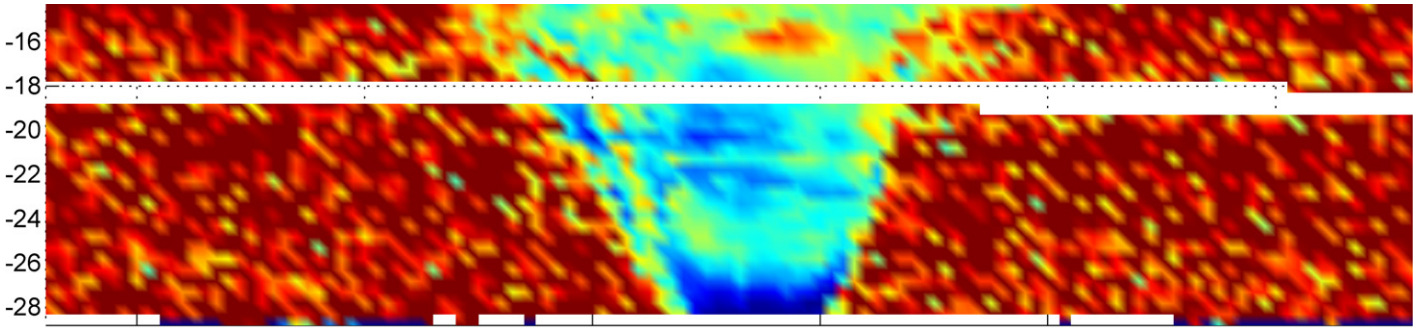
The experiments have been very successful, and an extensive dataset is now available and under analysis before publication



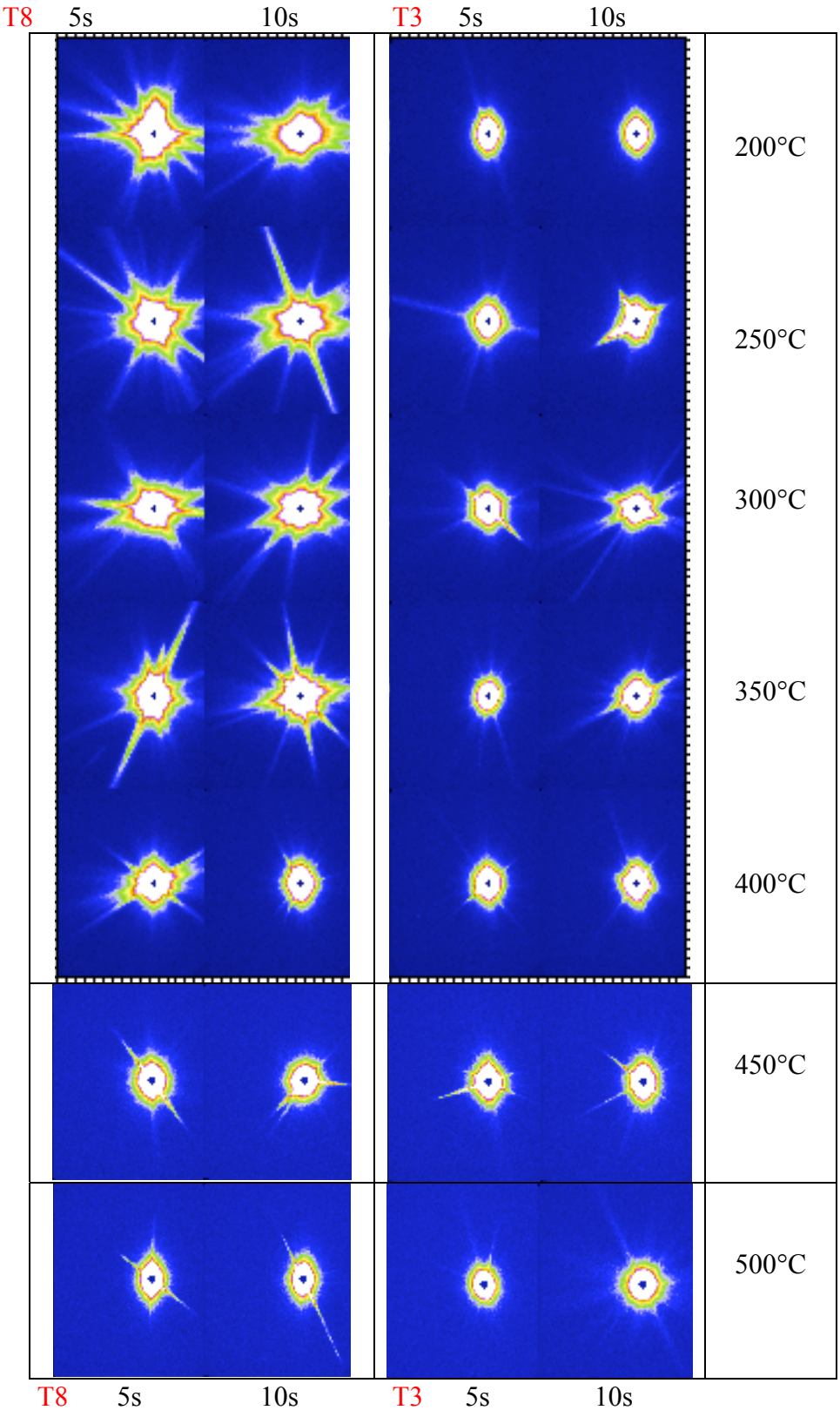
Map of precipitate volume fraction (arbitrary unit) in the weld cross section of the T8W weld, showing the extension of the fully dissolved zone (dark blue), and of the partially dissolved zone (light blue)



Same as figure above, but showing the individual images in some locations of the weld cross-section. These images demonstrate that the weld nugget microstructure is composed of isotropic solute clusters (SAXS halo), wheras the base material is composed of non isotropic T1 platelets.



Map of the precipitate volume fraction (arbitrary unit) in the weld cross-section of the T3WT8 weld, showing that the material in the weld nugget did not reach theprecipitation state of the base material during the post-welding ageing treatment.



SAXS images of samples initially in the T3 or T8 condition and subsequently aged 5 or 10s in a salt bath, showing the range of temperatures where precipitation or precipitate dissolution can occur.