# In situ nanotomography investigation of cavity nucleation and growth in light alloys during high temperature deformation

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Amphitheater Jean Besson (Phelma Campus)

**Jury:**

- M. Andras BORBELY, Directeur de recherche, Ecole des mines de Saint Etienne, Rapporteur
-M. Jean Yves BUFFIERE, Professeur, INSA de Lyon, Rapporteur
-Mme. Martine BLAT-YRIEIX, Ingénieurs de recherche, EDF, Examinateur
-M. Guillermo REQUENA, Professeur, Technische Universitat Wien, Examinateur
-M. Remi TUCOULOU, Beamline Operation Manager, ESRF, Invité
-M. Jean SUSINI, Directeur de recherche, ESRF, Invité

**Abstract**: In context of understanding high temperature deformation in light alloys, nucleation and growth of cavities has been widely studied. However, while theoretical research of this has been widespread, experimental investigations remain limited. The main reason for this has been a lack of suitable characterization tools that allows in situ investigation of nucleation and growth of cavities at high spatial resolution (smaller than 1 µm).

In the present work new fast in-situ X-ray nanotomography setup has been developed on the ID16B beamline at the ESRF which provides for a possibility for such investigations. This involved development of two mechanical devices that could fit in a furnace in order to perform 4D in situ damage analysis at high temperature (below 1073 K).

A model Al 3.6 % Cu alloy, subjected to controlled generation of second phase particles has been investigated using this novel technique to investigate in real time nucleation and growth of damage. Furthermore, a comparison of these results with the existing theoretical models, to deduce the defining mechanism of damage has also been done.

In addition, commercial magnesium alloy AZ31, has been deformed under superplastic conditions, while performing real time imaging at high resolution (pixel size 100 nm). This has been used to study early stages of deformation resulting from grain boundary sliding and further comparisons of experimental results have been made to existing models.

This study has helped in providing experimental data in regimes which could not have been investigated experimentally earlier.