Report on: „Holotomography on Al-Si short fibre reinforced metal matrix composite after different creep exposure times“ (MA300)

Synchrotron microtomography of an AlSi12CuMgNi alloy reinforced with 15 vol% of Saffil® short Al_2O_3 fibers samples (AlSi12CuMgNi/Al_2O_3/15s) was carried out at the ID19 beamline using the acquisition modes as indicated below:

1- AlSi12CuMgNi/Al_2O_3/15s non-crept samples: **spatial resolutions:** 0.28 µm/voxel and 0.7 µm/voxel; absorption, phase (2 distances) and phase retrieval (holotomography).

2- AlSi12CuMgNi/Al_2O_3/15s after long term creep exposure:

200 hs of creep exposure at 300°C (200G).
1080 hs of creep exposure at 300°C (1080G).
2200 hs of creep exposure at 300°C (2200G).
2910 hs of creep exposure at 300°C (2910G)
6400 hs of creep exposure at 300°C (6400G)
7060 hs of creep exposure at 300°C (7060G)

Spatial resolutions: 0.28 µm/voxel and 0.7 µm/voxel; absorption, phase (2 distances) and phase retrieval (holotomography) were used.

3- AlSi12CuMgNi/Al_2O_3/15s after long term exposure at 300°C (without applied load):

200 hs of temperature-only exposure (200T).
1080 hs of temperature-only exposure (1080T).
2200 hs of temperature-only exposure (2200T).
2910 hs of temperature-only exposure (2910T)
6400 hs of temperature-only exposure (6400T)
7060 hs of temperature-only exposure (7060T)

Spatial resolutions: 0.28 µm/voxel and 0.7 µm/voxel; absorption, phase and phase-based retrieval (holotomography) were used.

4- Deep etched AlSi12CuNiMg/Al_2O_3/15s non-crept samples in order to visualize the 3D Si-Al_2O_3-short-fibres structure. **Spatial resolutions:** 0.28 µm/voxel and 0.7 µm/voxel; absorption only.

All the measured samples are related to the study of creep mechanisms acting on the short fiber reinforced AlSi12CuNiMg alloy. The aims of these investigations were:

a) The identification and characterization of the three-dimensional reinforcing network formed by the Si and the short fibers and its evolution after different exposure times. Due to the low contrast between certain constituent phases (i.e. Al-Si), different sample-detector distances were used to improve it. The phase-retrieval reconstruction method was applied as a possible solution. Fig.1 a) to c) show reconstructed slices of the short fiber reinforced composite for detector-to-sample distances of 5, 20 and 50 mm, respectively. The so far obtained reconstruction using phase-retrieval is shown in Fig. 1 d). The contrast between Al and Si is still not enough to separate these phases and requires further improvement.

b) The identification of voids and intermetallic particles, the determination of their volume fraction and morphological evolution during creep exposure.

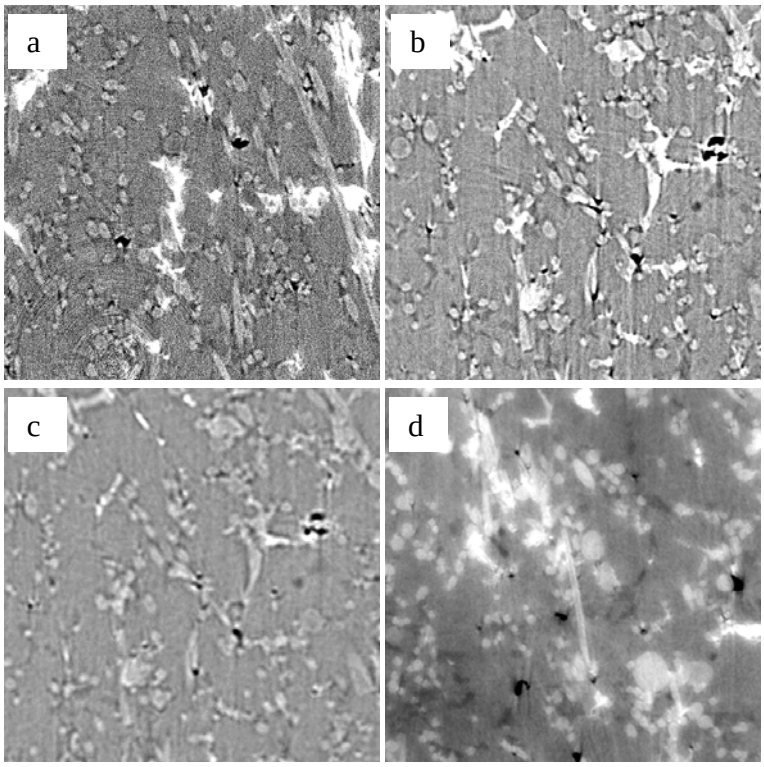

Figure 1. Reconstructed slices of the short fiber reinforced composite after 6400h of creep exposure at different modes: a) detector-to-sample distance = 5mm, b) detector-to-sample distance = 15 mm, c) detector-to-sample distance = 50mm, d) holotomographic reconstruction.