PHASE TRANSFORMATIONS IN Al-Li-BASED ALLOY STUDIED BY IN-SITU TEM.

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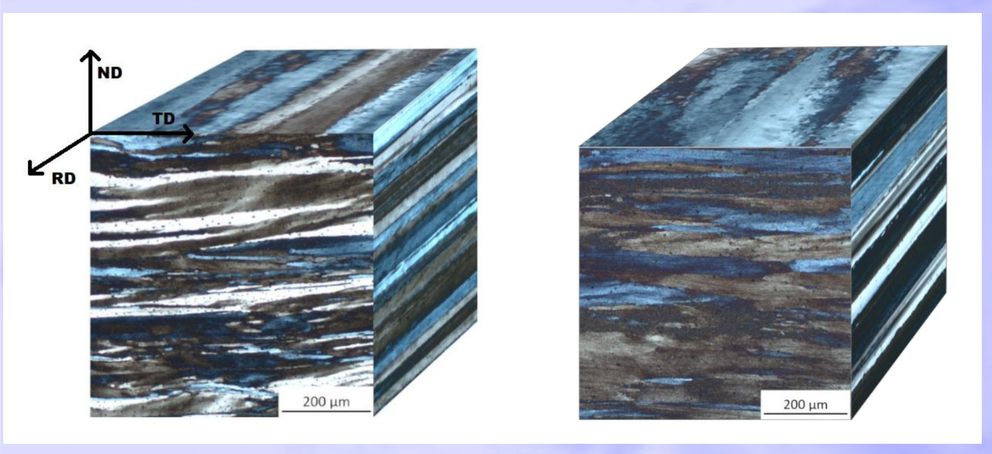
Motivation

Al-Li based alloys of AA2195 type are designed mainly for aerospace applications. They exhibit a very high strength due to a presence of strengthening precipitates of a nanometric size. Phase transformations occurring at selected temperatures could be characterized using in-situ transmission electron microscopy (TEM) annealing experiments. Nevertheless, the processes could be significantly influenced by a constrained volume of thin foils used in TEM.

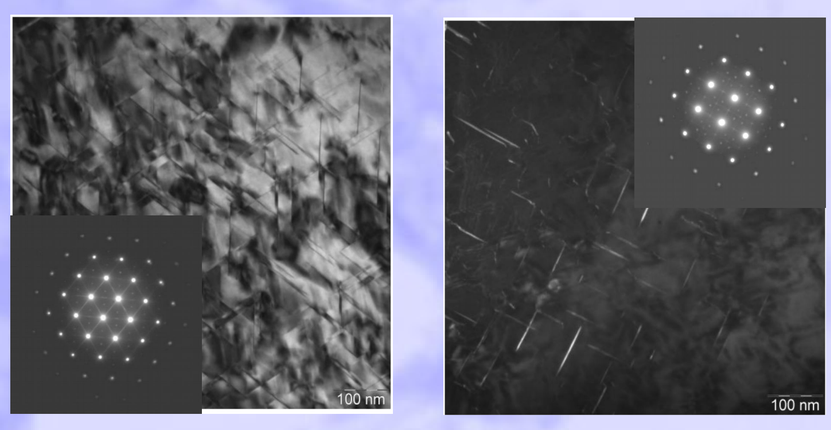
Experimental procedure

Chemical composition of studied alloy is (wt.%) 3.7% Cu, 0.8% Li, 0.4% Mg, 0.3% Ag, 0.1% Zr, 0.25% Zn. The rest of the elements such as Fe (0.15%), Si (0.12%) a Ti (0.1) is considered as an impurity in the alloy. Light optical microscopy (LOM) (Olympus GX51) and transmission electron microscopy (TEM) (JEOL JEM 2000FX and JEOL 2200F) observations were used for the material characterization.

As-received state

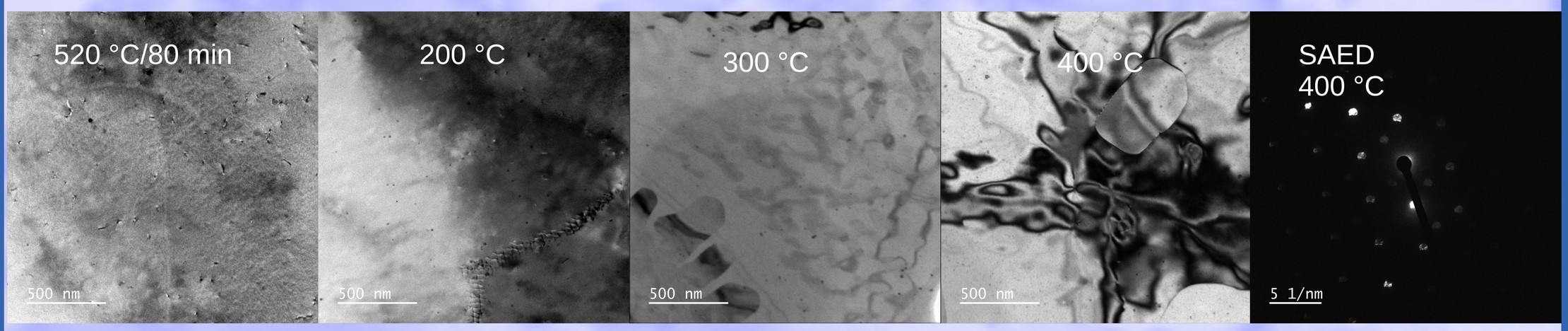


Structure of as-received plate (LOM) in a peak-aged conditions



(Left): TEM bright field image of T1 (Al_2CuLi) and θ' (Al_2Cu) plates, and selected area electron diffraction pattern near [110] Al orientation, and (right) TEM dark field image of θ' (Al_2Cu) plates and SAED near [100] Al orientation.

In-situ TEM annealing



Precipitation of T1 (Al_2CuLi) plates in thin TEM foil during isochronal annealing with an effective heating rate 10 K/min. SAED images near [110] Al orientation evinced only a presence of reflections from one family of T1 phase.

Summary

Formation of plate-like T1 (Al_2CuLi) and θ' (Al_2Cu) precipitates is strongly influenced by a constrained volume of a thin foil. Only plates laying in planes nearly parallel with the foil surface were formed.

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