Dislocation interaction with an Al-Cu aged alloy

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Aluminum alloys benefit from the formation of precipitates at a very fine scale to gain their excellent specific mechanical properties. However, heavier Ti-alloys are usually preferred when the long-term operating temperature is above 100°C. This is in particular the case, but not only, for parts on aircraft structures.

Our aim is to investigate the possibility to increase this operating temperature in order to challenge titanium alloy parts with Al-Cu alloy ones and thus allow weigh reduction.

As the plastic properties of the Al-Cu alloys are correlated to the interaction of dislocations with the nanoscale precipitates, *in situ* straining in TEM have been performed to observe dynamically the dislocations-precipitates interactions. Difficulties encountered this study are not only due to the high fluctuations of the background but are also due to the contrast of the high-density precipitates and to the local strain generated in the Al-matrix by the precipitates. In order to overcome the setback of this noisy high contrast, specific experimental TEM observation conditions have been defined, and experiment in dark field dual beams condition was selected. To do so, a JEOL JEM2010 equipped with a LaB_6 filament was used at 200 kV.

These experiments allow the dynamic observation of gliding dislocations, which are surrounding the precipitates and left a dislocation loop around them, according to the so-called "Orowan process". On the same precipitates have also been observed multiple dislocation loops on various gliding planes on the precipitates present in the $\{001\}_{Al}$ planes.