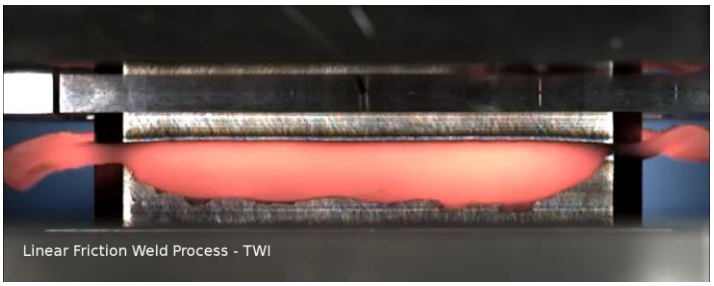
Mechanical characterization of Titanium Linear Friction Welds

Juan-Manuel GARCIA
(2016 – 2019)

Industrial Partner: ANR Project – AirBus – ACB
Supervisors: Thilo MORGENEYER



- Elasto-plastic behavior of welded structures under strong mechanical solicitations.
- Fatigue behavior and fracture behavior under High cycle fatigue.

Abstract:

Titanium (Ti) alloys are widely used in the aerospace industry. Its excellent corrosion resistance, mechanical resistance and low density give them increasing importance. A need to improve the buy-to-fly ratio is raising, *e.g.* by the use of novel joining techniques. LFW is a recent solid state joining process that works as follows: A cantilever work piece is in contact with another following a linear oscillatory motion. After a few seconds of friction, a forge pressure is applied in order to achieve a target axial shortening. Impurities in the contact surface and mass are extruded to the surroundings. This process is very quick, auto-cleaning and presents few defects. High levels of plastic deformation and localized heat are generated around the weld interface. Thus micro structural changes, unknown mechanical properties and considerable levels of residual stresses are found in the surroundings of the weld line.
This study relies on the mechanical characterization of the joints and the detection of potential defects caused by the process. The first step consists in the non destructive X-Ray observation of the weld interface. The possible presence of cavities is studied. Secondly, parent materials and LFW joints welds tensile tests results are compared. Thirdly, the plausible contamination caused by the block machining is analyzed. A study of the local strain field of the specimen surface compared with a microhardness analysis have been performed to get a better understanding of the elasto-plastic behavior of the weld. Finally the fracture behavior under high cycle fatigue is studied.