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Compression testing results

UBS n°12 – 12/11/06

Objectives

- To determine the influence of tightening during curing on mechanical properties of a stack of conductor.
- To observe if there is an improvement of mechanical properties with conductor consolidated at 120 MPa.
- To prepare conductor consolidated at 2,95 mm for future tests.

Summary of test results

- Remove the Kapton and apply only a B stage insulation improves significantly the stiffness of a stack of conductor, at the condition that the stack of conductor is pressed by screws tightening before and during curing process.
- In these manufacturing conditions (screws tightening at 40 N.m before and during curing) there is no improvement of the mechanical properties between production conductor without consolidating and conductor consolidated at 120 MPa.
- According to thickness measurements, better geometry of conductor is obtained with consolidating at 2,95 mm than with consolidating at 120 MPa.

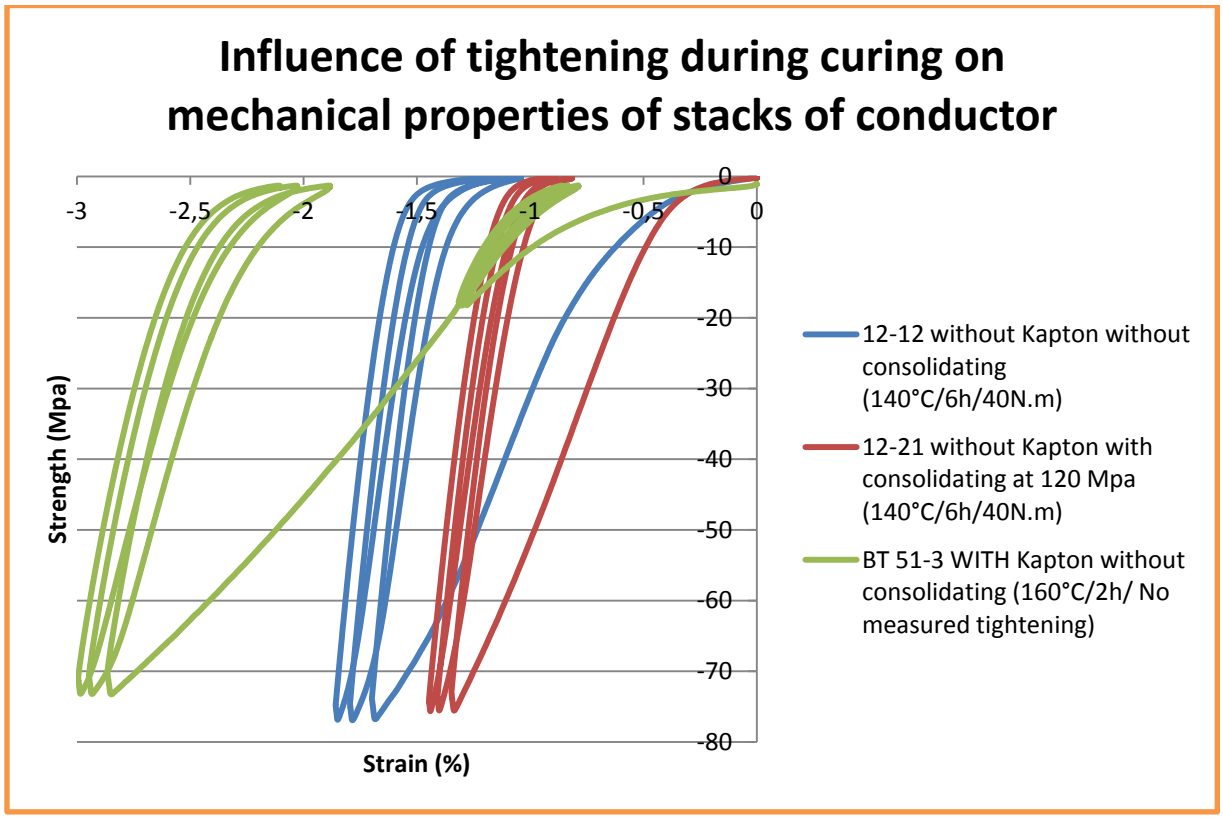
Future tests

The aim of next tests is firstly to compare the stiffness get with pre-impregnated wrap to the stiffness get with vacuum molding. In parallel we will determine if mechanical properties are improved with a consolidating at 2,95 mm associated with vacuum molding.

Results

The following figure is a comparison between stacks of conductor without Kapton only with BStage.

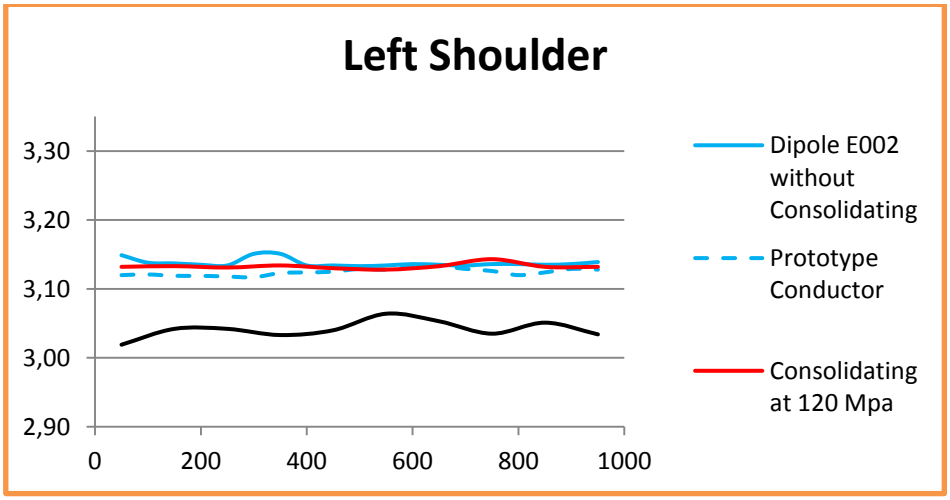
- One stack (BT51-3 - UBS compression tests n°6) was insulated with Kapton and BStage and wasn't tightened before or during curing. Moreover the resin wasn't blocked during curing. Consequently it remains gaps between layers of conductor, especially between conductor and Kapton.
- Another stack (12-12) has been tightened at 40 N.m before curing and also after one hour of curing at 140°C. The second tightening implied a displacement of screws of about 3 mm (about 10% of strain for the stack of conductor). Consequently the resin removed from BStage and filled the voids.
- The same process is applied on a stack of consolidated conductor at 120 MPa (12-21)

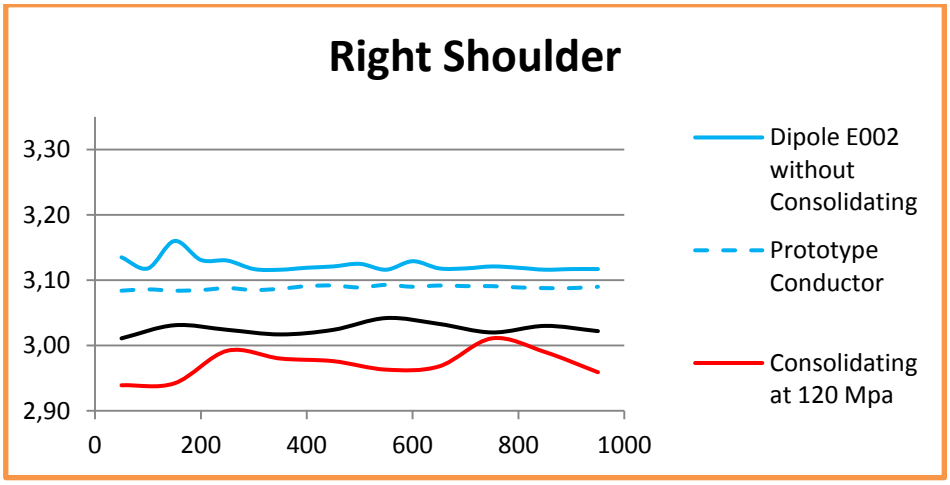


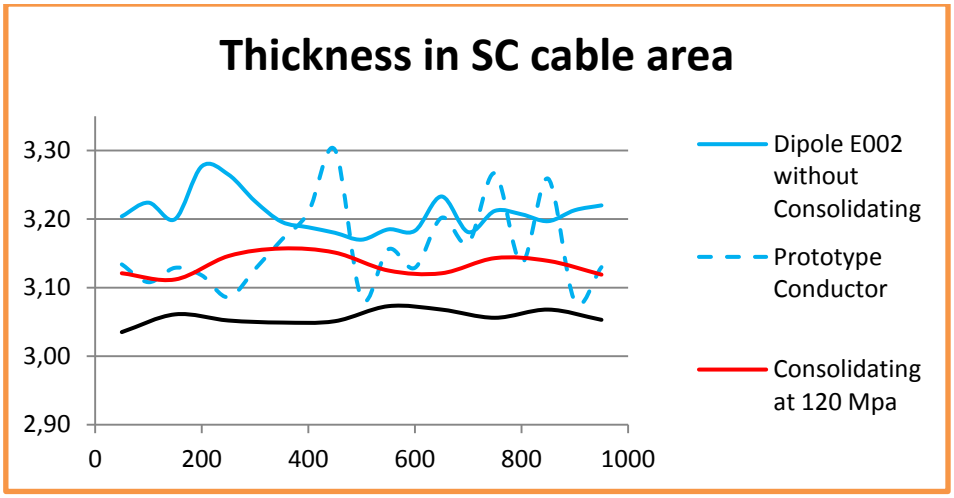
We observe that tightening at 40 N.m during curing and removing of the Kapton improves significantly the stiffness of the stack: the Young's modulus with double tightening at 40 N.m is of about 8 GPa against 3.5 GPa with no tightening during curing.

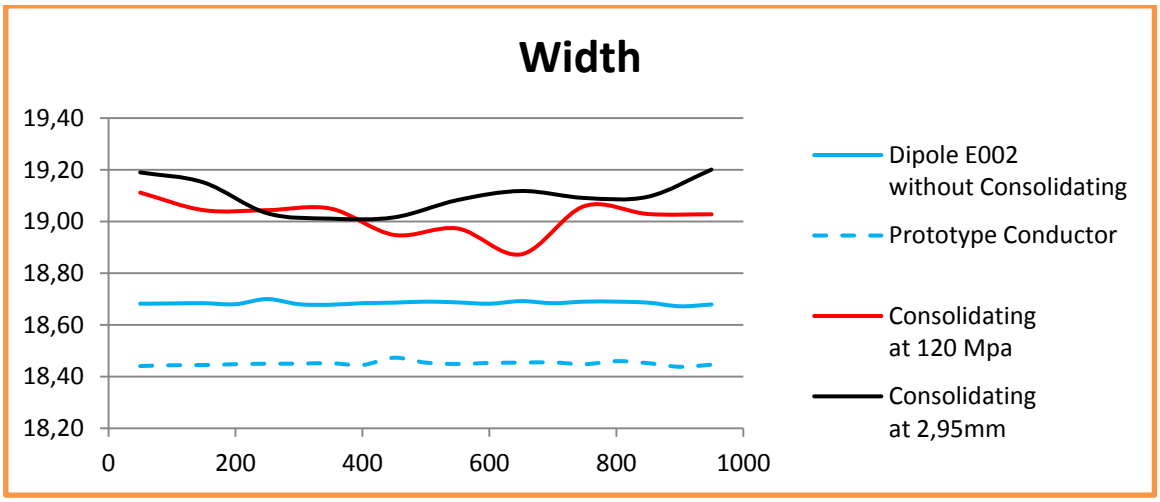
There is no significant improvement of the Young's modulus of the stack when conductor is consolidated at 120 MPa.

The following graphs show thickness measurements every 50mm on bare conductors of one meter. We measured thickness of left and right shoulder, the maximum thickness in SC cable area and width. These measurements are done on production conductor, prototype conductor, consolidated at 120 MPa and consolidated at 2,95mm.









The following graph is a comparison of thickness before and after consolidating at 2,95mm. Thickness of left and right shoulder and the maximum thickness in SC cable area are measured every 10mm.