



# Transverse biaxial tests on long fibre reinforced composites

P.L. Zumaquero, E. Correa, J. Justo, F. París

Group of Elasticity and Strength of Materials  
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**Measuring transverse strength of UD plies in static tension or compression**  
**October 20<sup>th</sup>, 2022**



Unión Europea

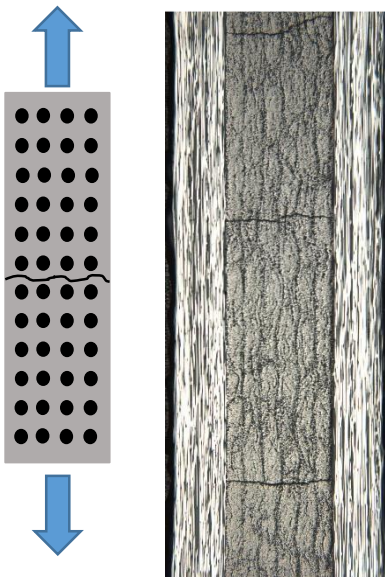
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**Projects P18-FR-3360 and P18-FR-3855**

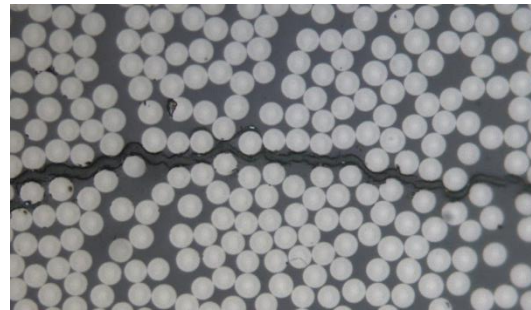
## TRANSVERSE FAILURE-UNIAXIAL LOADS

### TENSION

MACRO-LEVEL

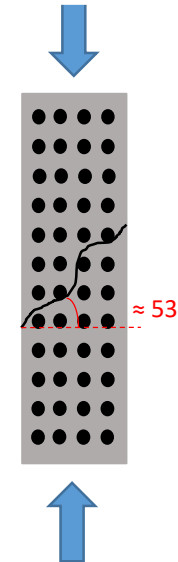


MICRO-LEVEL

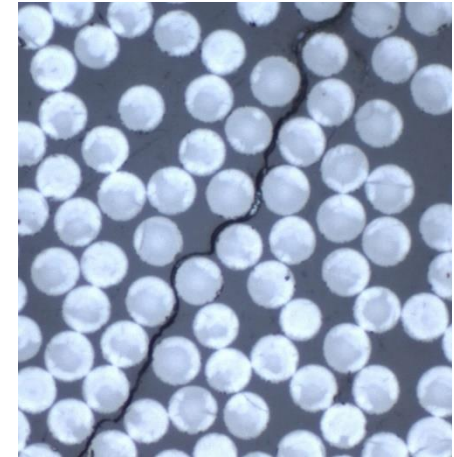


### COMPRESSION

MACRO-LEVEL

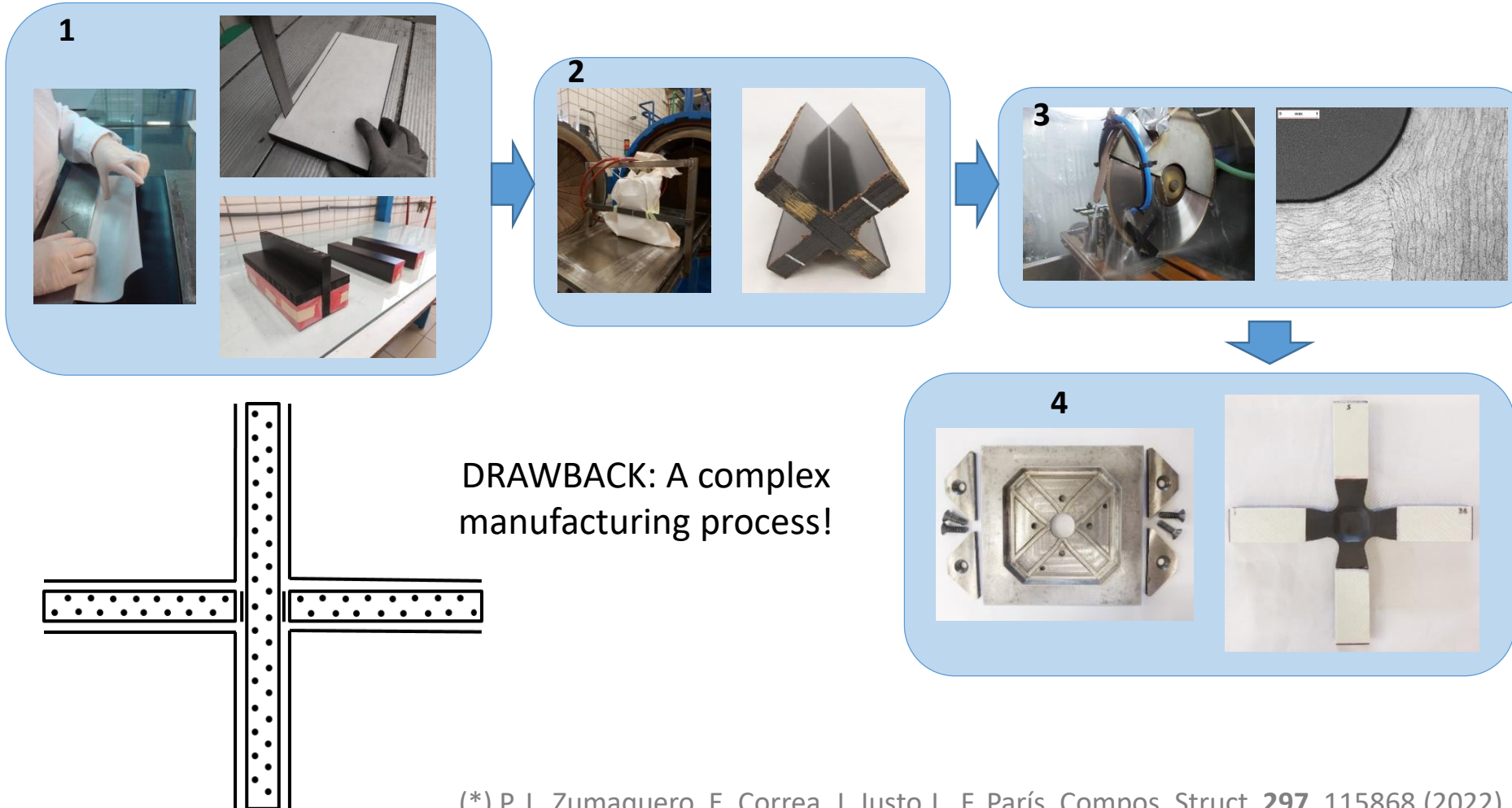


MICRO-LEVEL

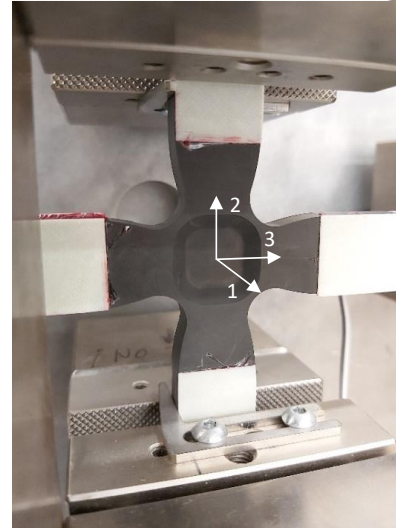
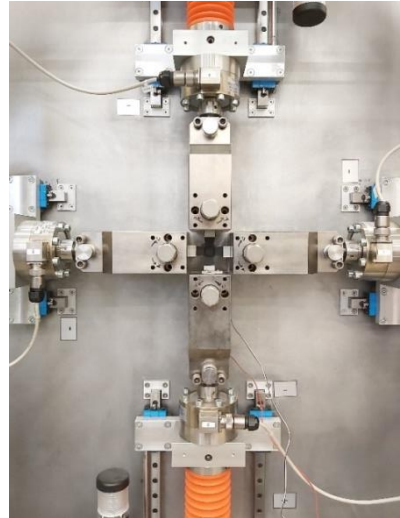


**BIAXIAL LOADS?**

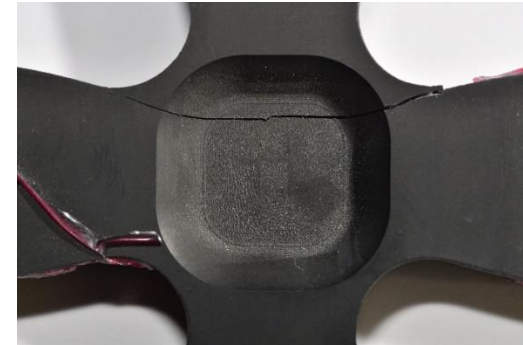
## EXPERIMENTAL T-nT and T-nC TESTING CAMPAIGN



## EXPERIMENTAL T-nT and T-nC TESTING CAMPAIGN



AS4/8552 carbon-epoxy  
cruciform specimens

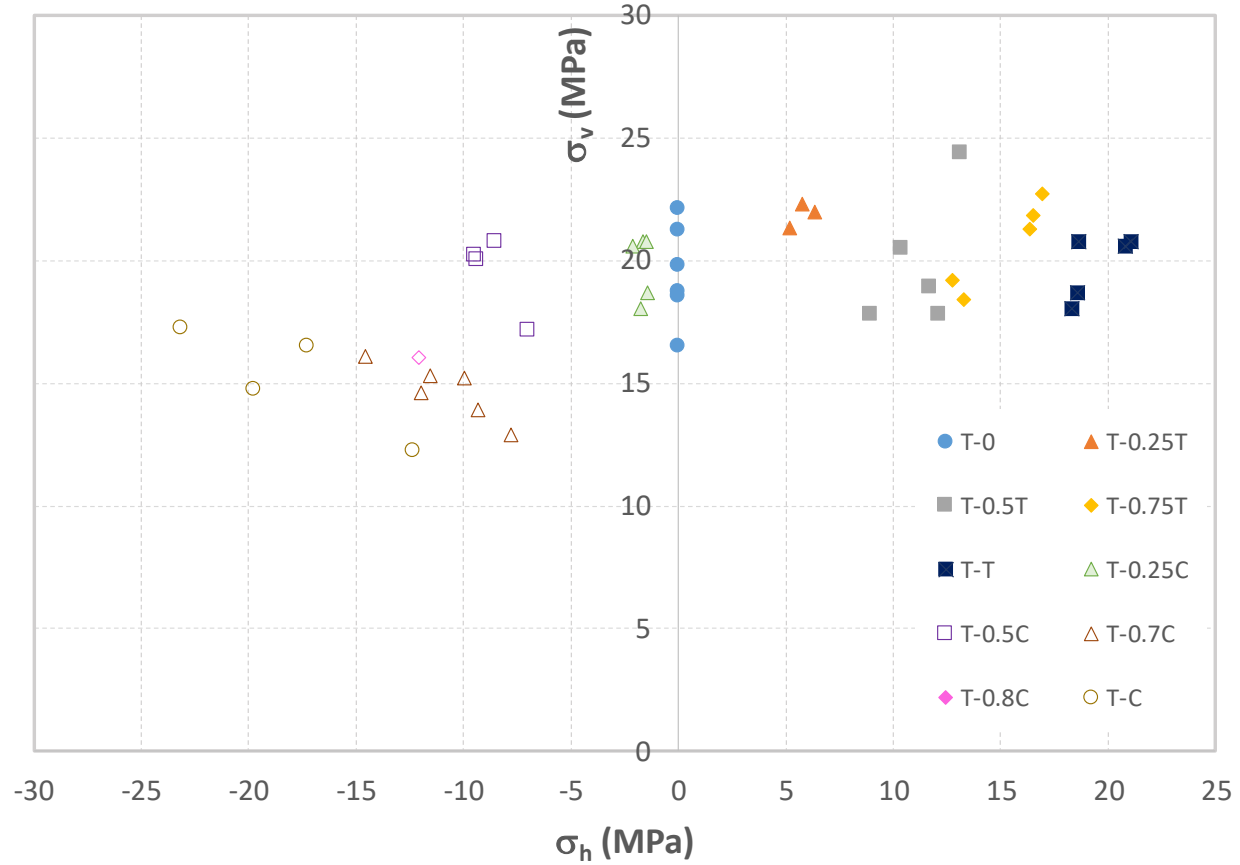
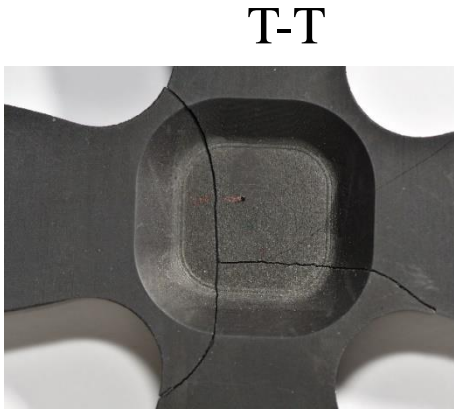


### MAIN RESULTS (\*):

- Effect of the secondary traction on the failure occurrence
- Orientation of the plane of failure
- Initial failure point
- Strain measurements at the centre of the specimen

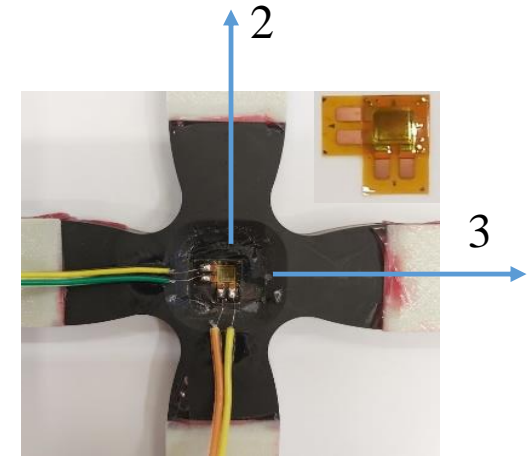
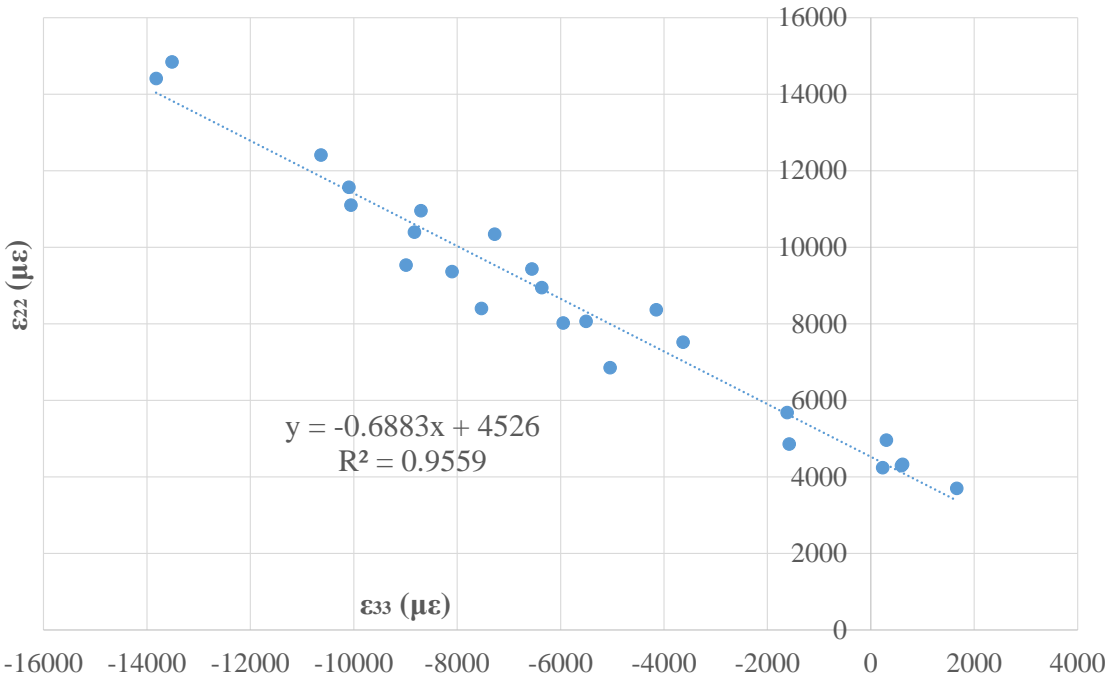
(\*). P. L. Zumaquero, E. Correa, J. Justo J., F. París, Compos. Struct. **297**, 115868 (2022)

'Apparent' stresses associated with the vertical and horizontal actuators:  $\sigma_v = F_v/A$ ,  $\sigma_h = F_h/A$



(\* ) P. L. Zumaquero, E. Correa, J. Justo J., F. París, Compos. Struct. **297**, 115868 (2022)

## $\epsilon_{22}$ versus $\epsilon_{33}$ (centre of the coupons)

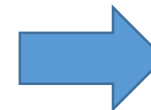


### Experimental

$$1.5\epsilon_{22} + \epsilon_{33} = \epsilon_{2T}$$

### Features taken into account in the numerical model (\*)

- Different stiffness values for tension and compression
- Different stiffness values for directions 2 and 3
- Non-linear behaviour



### Numerical

$$1.4\epsilon_{22} + \epsilon_{33} = \epsilon_{2T}$$

(\*) P. L. Zumaquero, E. Correa, J. Justo J., F. París, *Mechanics of Advanced Materials and Structures*, *accepted for publication*



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