Compaction behaviour of textile reinforcements

Novel test-rig design and analysis of influencing factors

Starting point

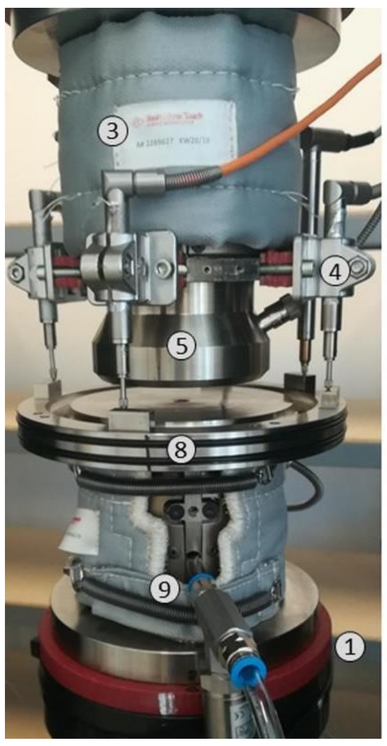
- Fibre reinforced composites are highly efficient, but expensive to manufacture and energy intensive
- To reduce waste and CO_2 emissions during production, we need to understand the material behaviour
- Available test methods do not mirror the most common manufacturing processes

Goal

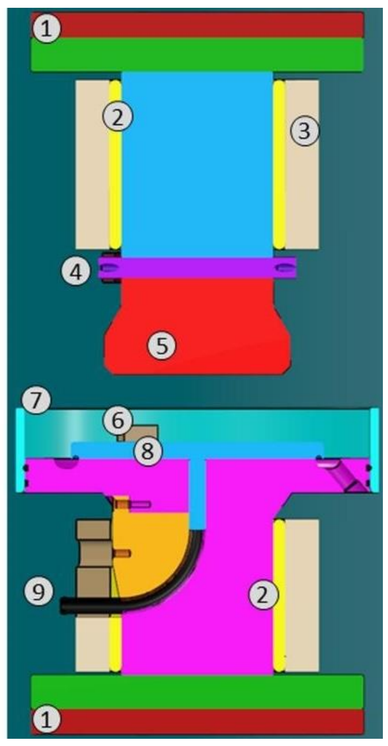
- Design a novel test-rig to match most common manufacturing processes (RTM, VARI)
- Develop a test method that saves time and materials
- Analyse the influence of:
  - Test fluid
  - Textile structure
  - Temperature and binder content

Test-rig design

- Lab-scale design integrated in UTM
- Easy all around access for specimen manipulation
- Active heating of test area up to 250 °C
- Combined test for dry and wet characterization
- Optional injection of fluids allows for in-situ impregnation of material samples

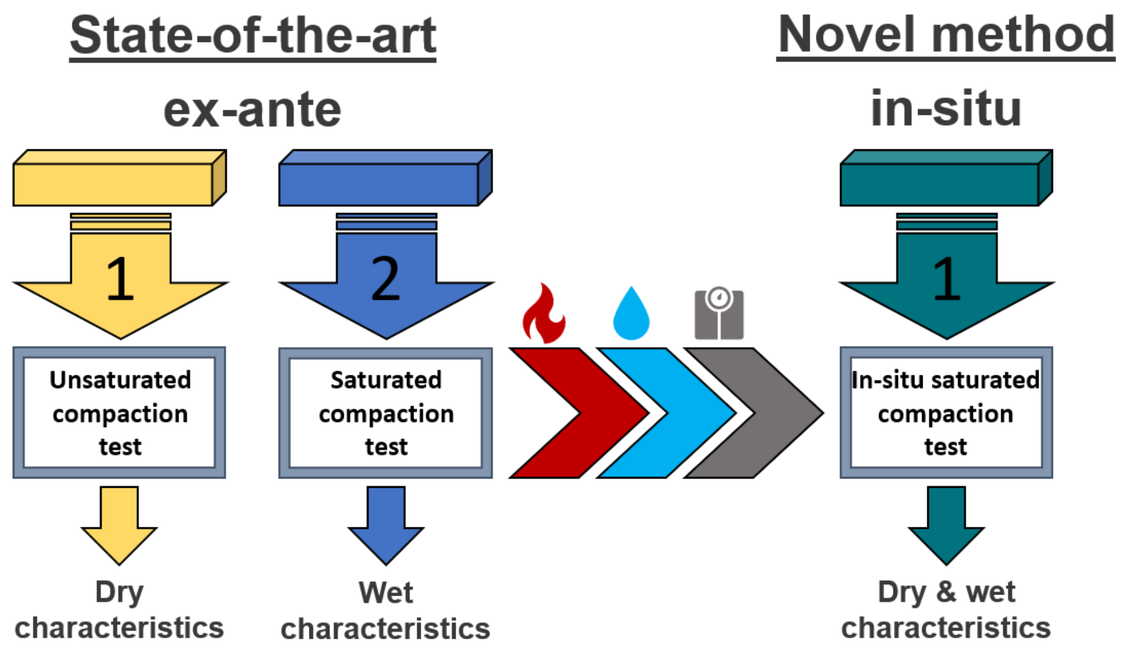


1) Insulation plate
2) Heating band
3) Insulation sleeve
4) 5 LVDTs
5) Stamp
6) Cover plate
7) Fluid barrier
8) Base plate
9) Fluid line



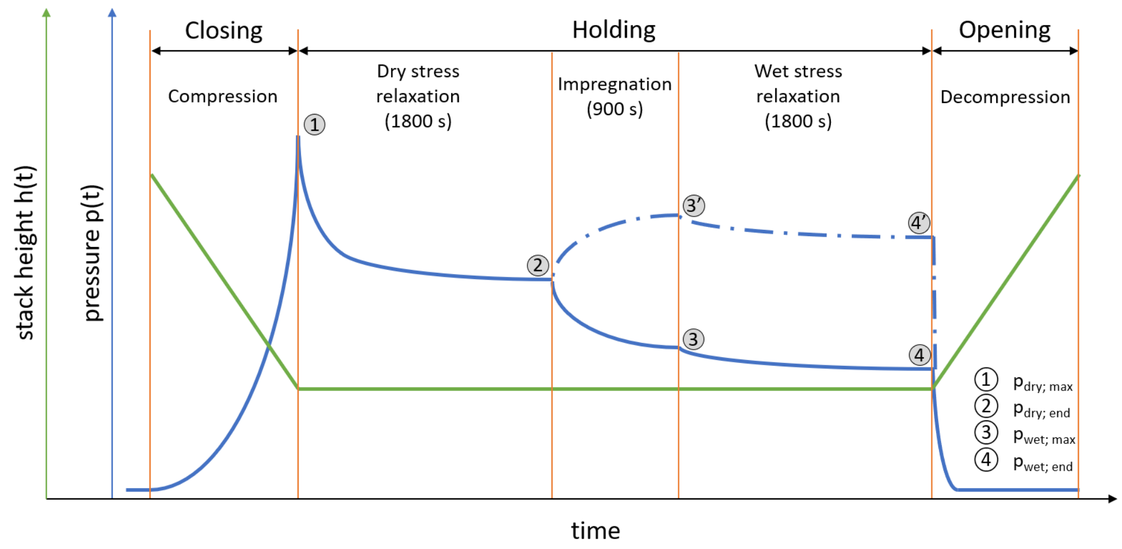
Test method development

- 50% reduced material consumption
- Reduced work load through high degree of automation



	ex-ante		in-situ
$p_{dry;\ max}$	✓	–	✓
$p_{dry;\ end}$	✓	–	✓
$p_{wet;\ max}$	–	✓	×
$p_{wet;\ end}$	–	✓	✓

- Schematic result of stress relaxation during in-situ test



Future work

- Analyse the influence of
  - Temperature and binder content
- Develop material model for in-line process control

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Composite manufacturing processes (RTM, VARI)

Thesis topic:
Transversal compaction behaviour of textile reinforcements

With support from:

TEIJIN