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On-line consolidation of thermoset prepregs : **Laminate quality analysis**

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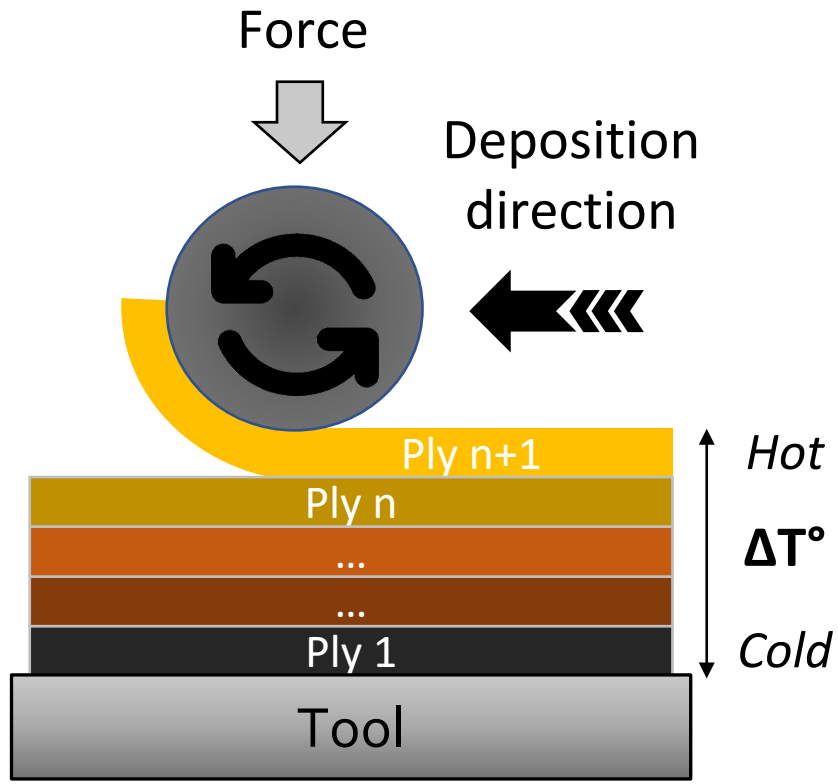
AIMS

- **Goal: Enhance the AFP process**

- **Current manufacturing processes :**
  - **3-steps process : Cold deposition**
  - **2-steps process : Hot deposition**
  - **1-step process : In-situ AFP**

- **Approach : Perform compaction tests to characterise materials and process**



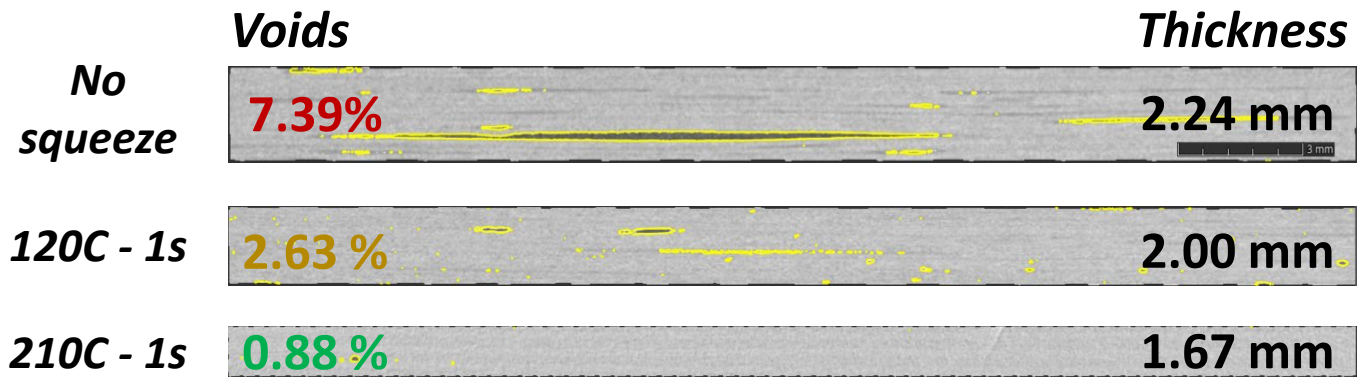
Desired one-step process

In-situ consolidation with thermosets: Curing during the AFP layup step

MATERIALS & OPPORTUNITIES

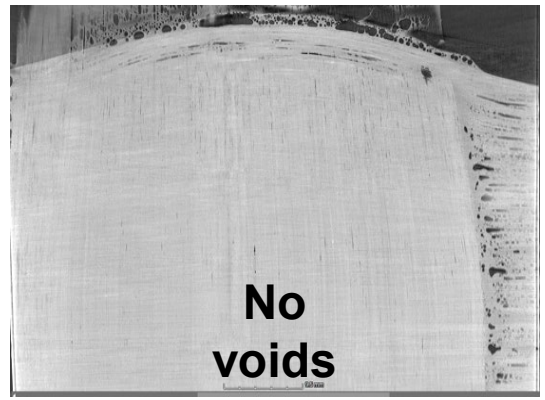
➢ **Out-Of-Autoclave prepreg (OOA)**: M56/IM7

- Cure cycle = 2h dwell @ 180°C
- AFP with higher temperatures would **permit high-quality preform production**



➢ **Snap Cure Resin prepreg (SCR)**: M78.1

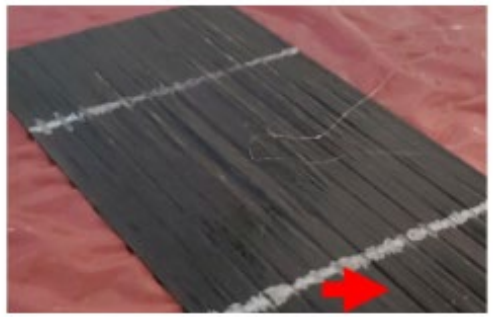
- Creation of **high-quality laminates** at lower processing temperatures
- Shorter consolidation processes



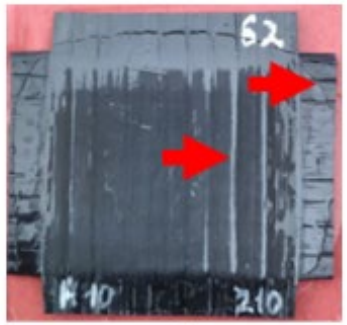
10 plies @ 120°C & 0.1Mpa – 2.5s/ply

OOA PREPREG CHALLENGES

- Creation of a network of voids during the ply-by-ply compaction
  - Applying heat to the prepreg plies can create grooves
    - **Need to accurately control process parameters**



a)



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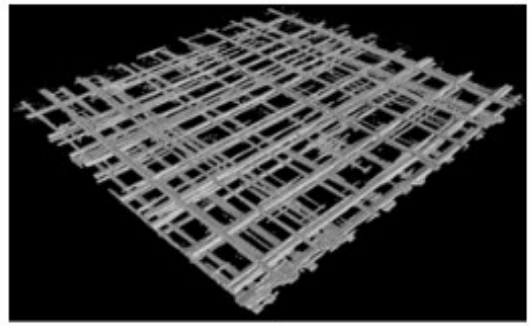

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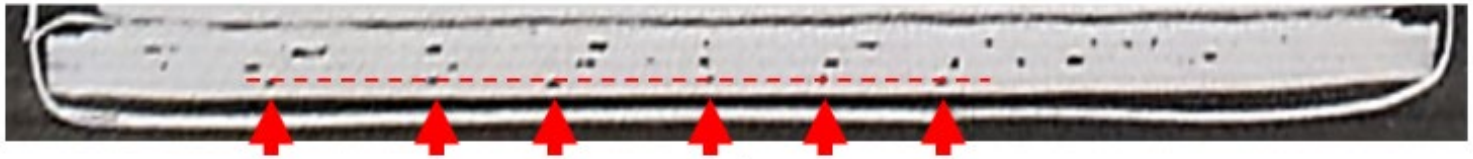

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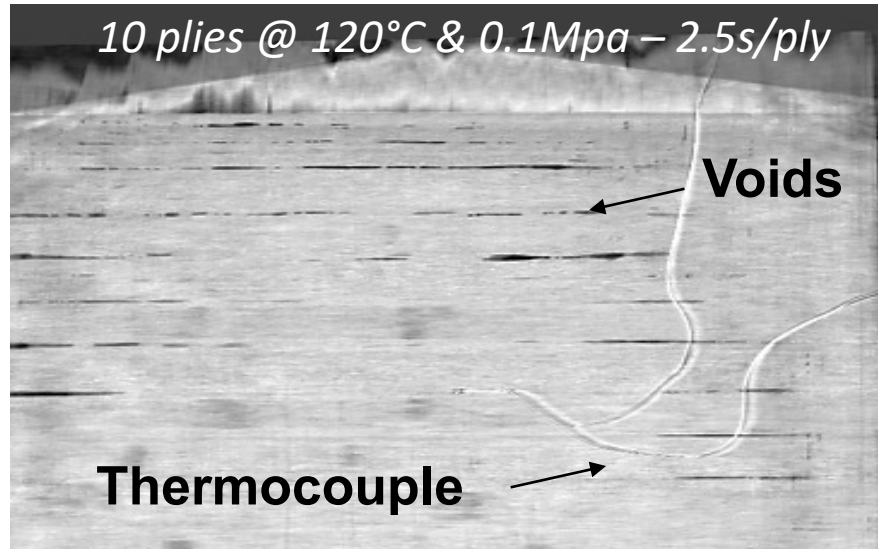

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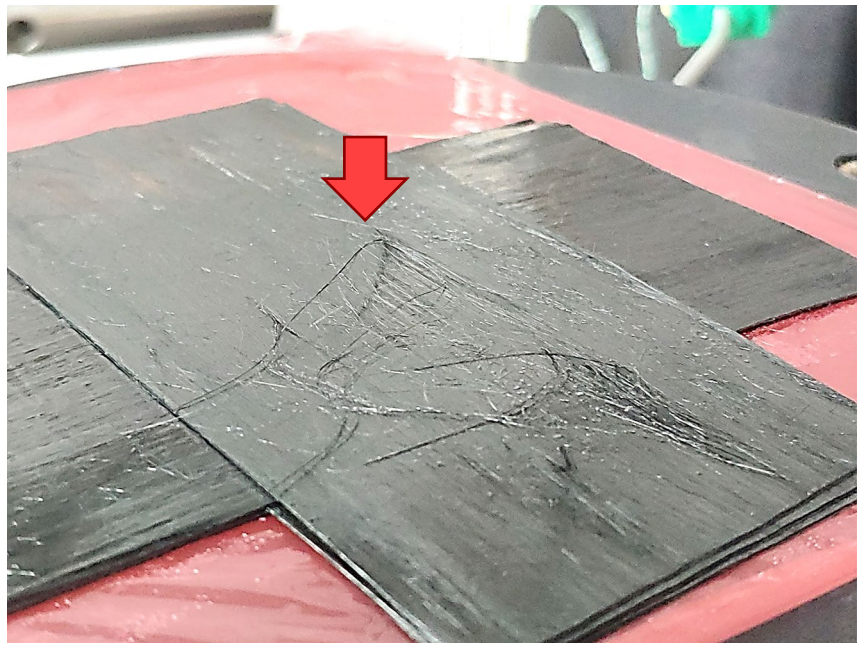
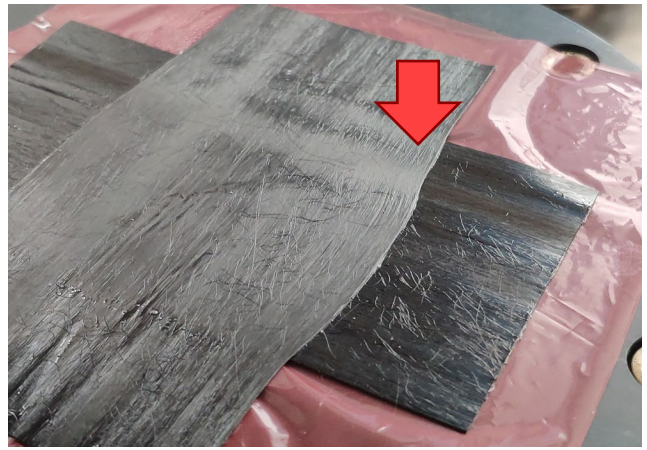
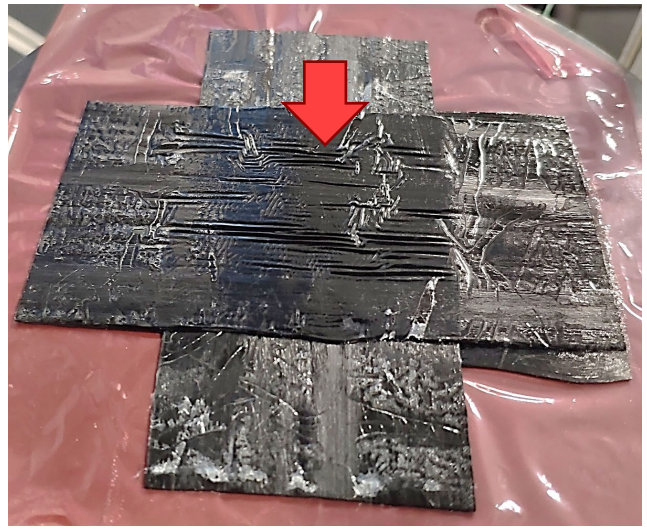
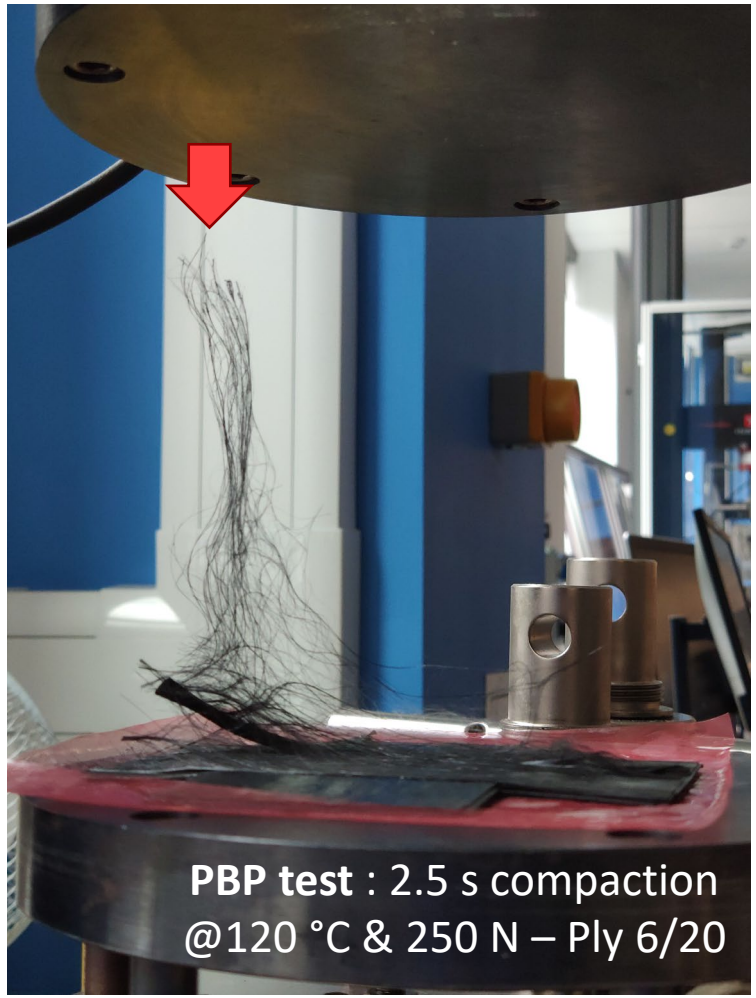
SCR PREPREG CHALLENGES

- Fibre alignment & stickiness
- Impregnation & flow issues
- Surface defects (channels)









CONCLUSIONS & FUTURE WORK

🔑 Key findings

🔑 **OOA prepreg** : High temperature AFP with = High-quality preform production

🔑 **SCR prepreg** : Great opportunities for short process & high-quality laminates

🎯 Goals

🎯 Degree of cure monitoring (Cure kinetics model)

🎯 Tackle lab-scale manufacturing challenges

🎯 Find optimal parameters for in-situ AFP

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PhD project:
Layer by Layer manufacturing of complex composites

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