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Infusion process monitoring of polymer-matrix composite using an IN SITU PZT sensor network: a multi-technique approach.

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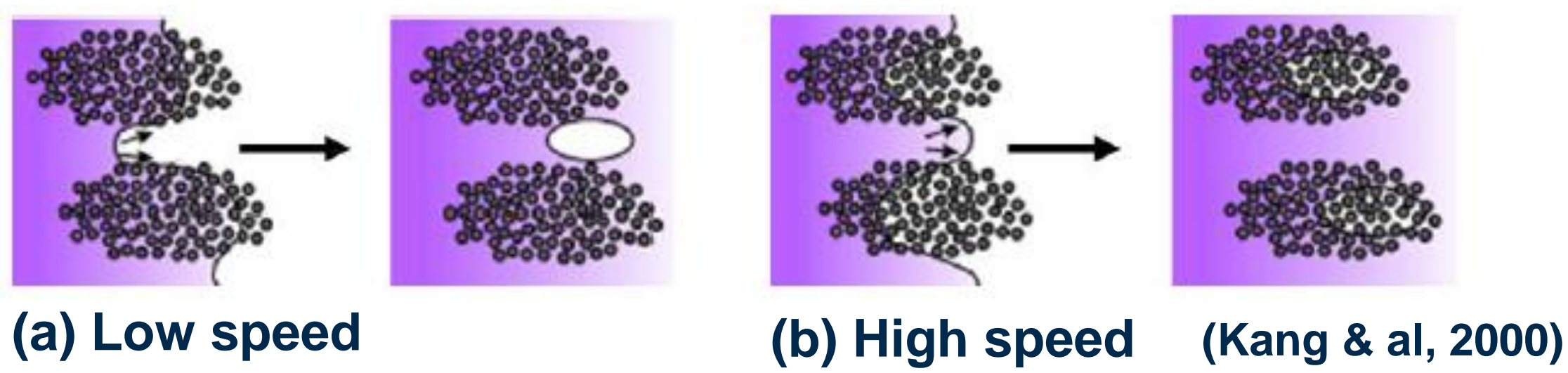
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Infusion process monitoring of polymer-matrix composite using an IN SITU PZT sensor network: a multi-technique approach

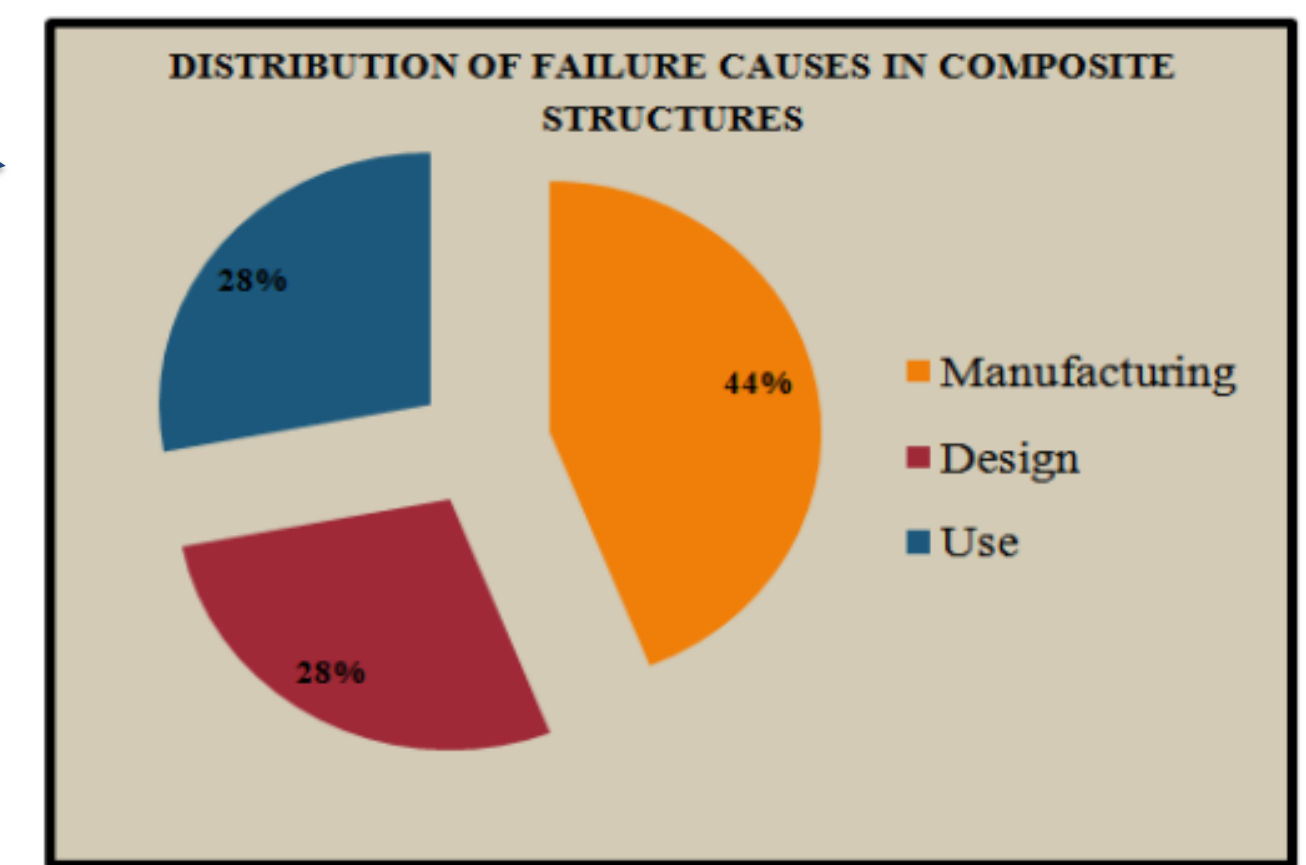
Corentin TULOUP¹, Walid HARIZI¹, Yann MEYER^{1,2}, Rémy LACHAT², Kamel KHELLIL¹, Zoheir ABOURA¹

Liquid Composite Moulding (LCM): Contact moulding, Infusion, Resin Transfer Moulding (RTM), etc.

Very complex phenomena involved (ex: fabric impregnation)



Not always well – mastered... 🤔



IDEA: IN and EX SITU multi instrumentation of the manufacturing process = infusion

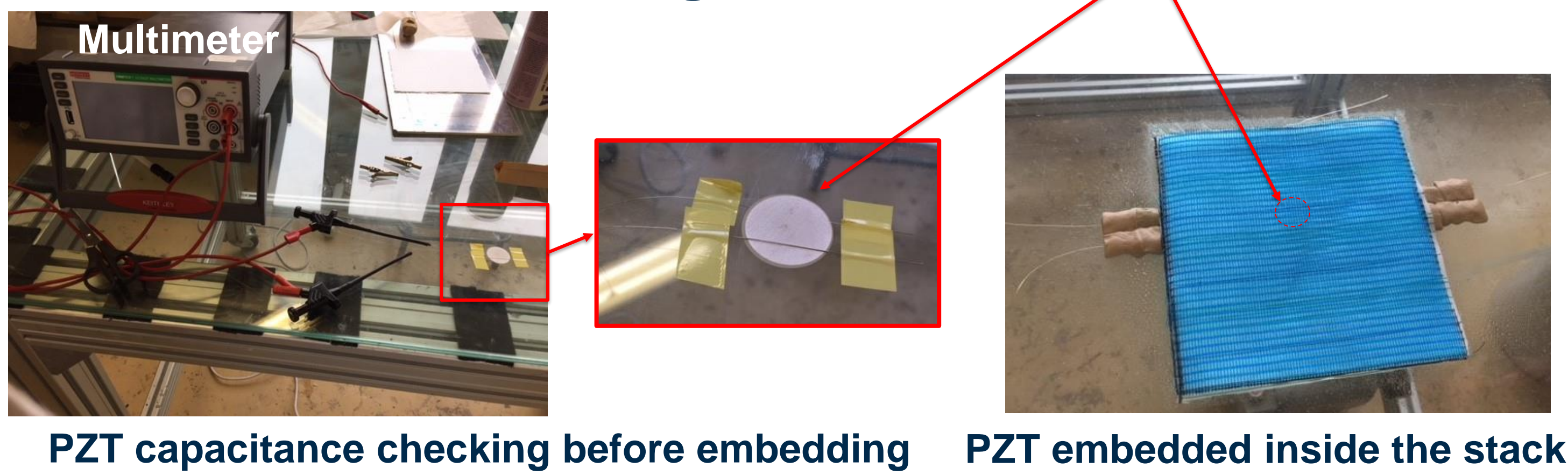
- Better understanding of the occurring phenomena
- Knowledge about the quality of the final product

1st experiment

2nd experiment

IN SITU instrumentation: Piezoelectric (PZT) sensors:
(Small plate, 1 IN SITU connected PZT disc)

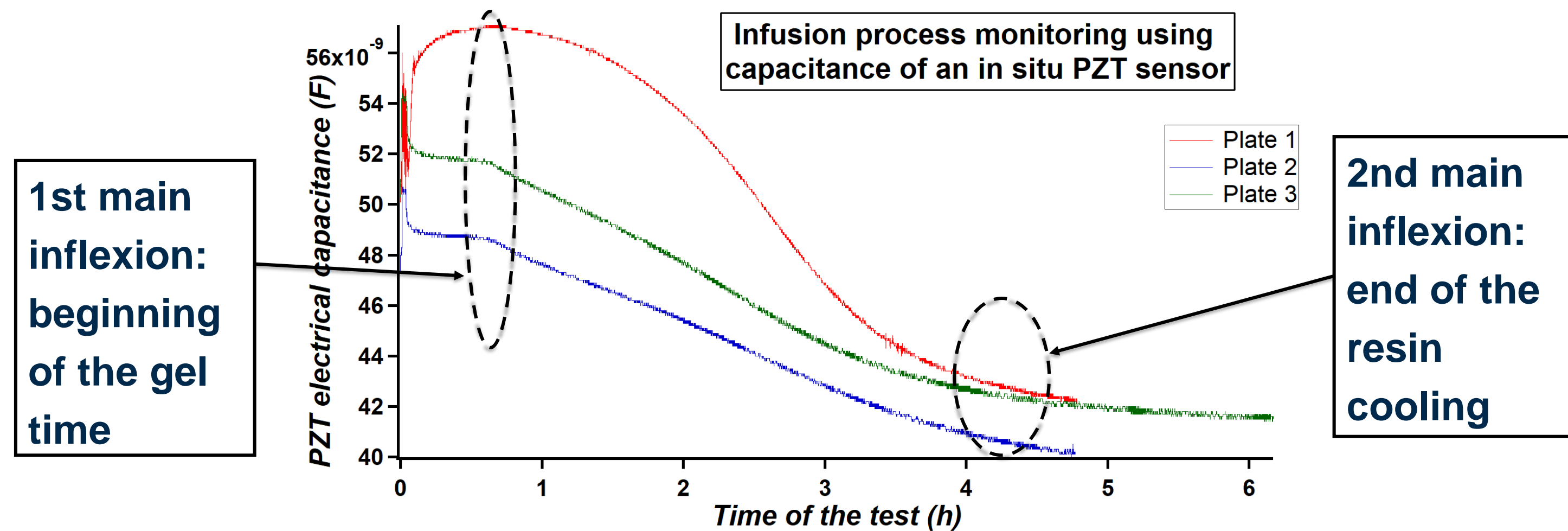
1/ PZT sensor embedding:



2/ Infusion realization:

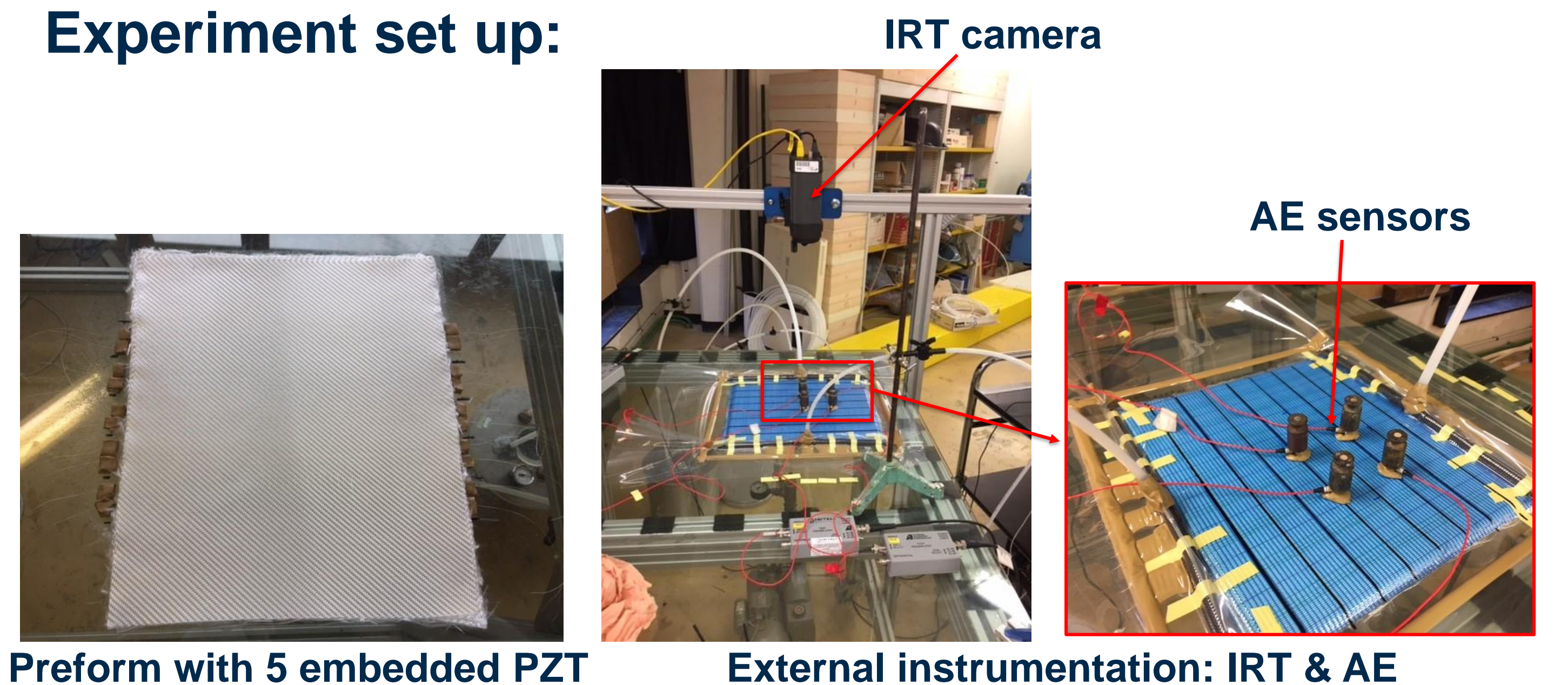


3/ PZT sensor capacitance variation during infusion:

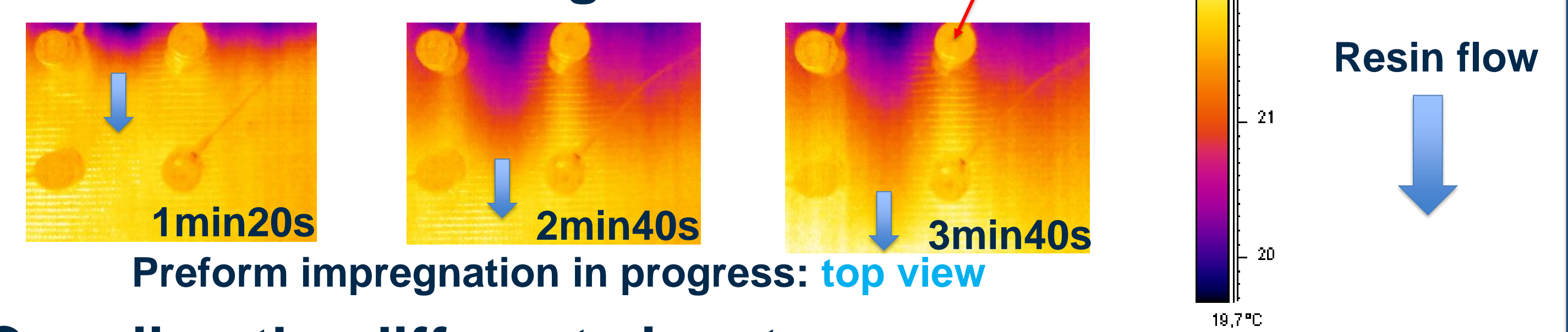


EX SITU instrumentation: Infrared thermography (IRT) camera & Acoustic Emission (AE) sensors:
(Large plate, 5 IN SITU disconnected PZT discs, 1 IRT camera, 4 AE sensors)

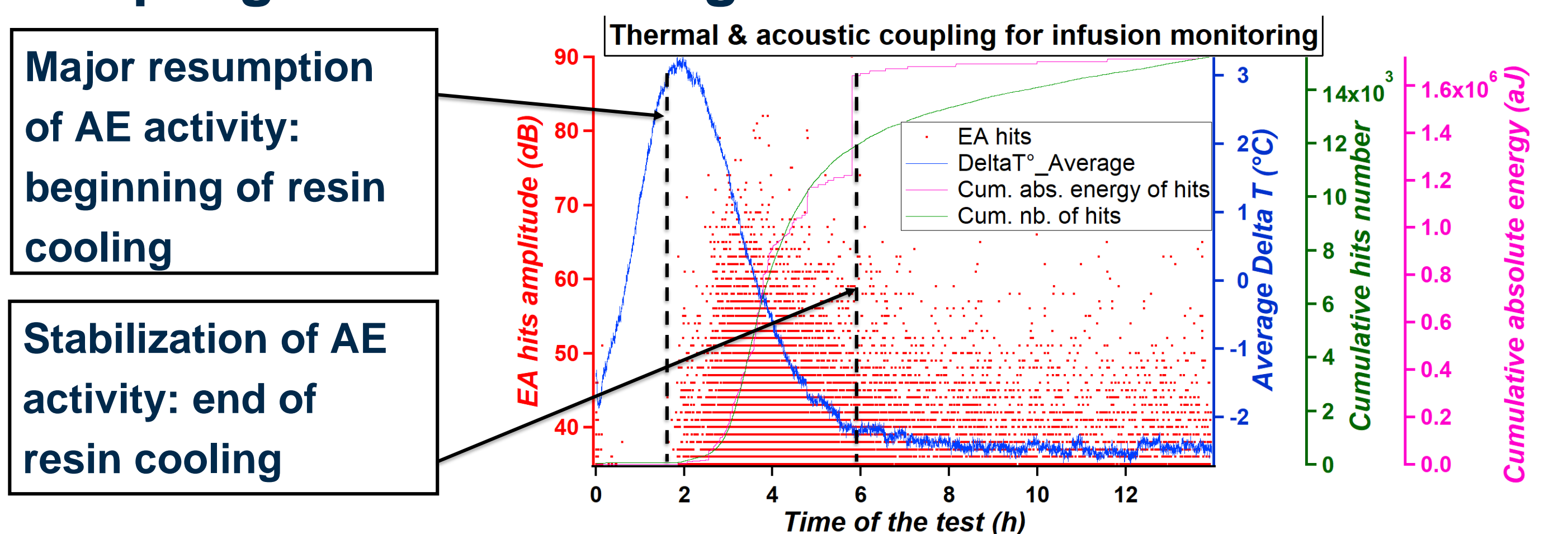
Experiment set up:



Resin flow monitoring with IRT: AE sensors



Coupling the different signatures:



Conclusion & Perspectives:

- IN SITU PZT capacitance + IRT + AE → a way to 'frame' resin curing → the 3 informations must be coupled → ongoing
- Impossible to localize the AE events due to the continuous change of properties of the medium
- For the future:
 - Large plate infusion monitoring with 5 in situ PZT disc used as AE sensors → comparison with external AE sensors information? Clustering (link between AE wave characteristics & physical phenomena) of the obtained data
 - Same experiment with central PZT disc as capacitance → influence of its vibration on resin flow?
 - Obtained 'smart' plates used for mechanical testing → IN SITU PZT as Structural Health Monitoring sensors