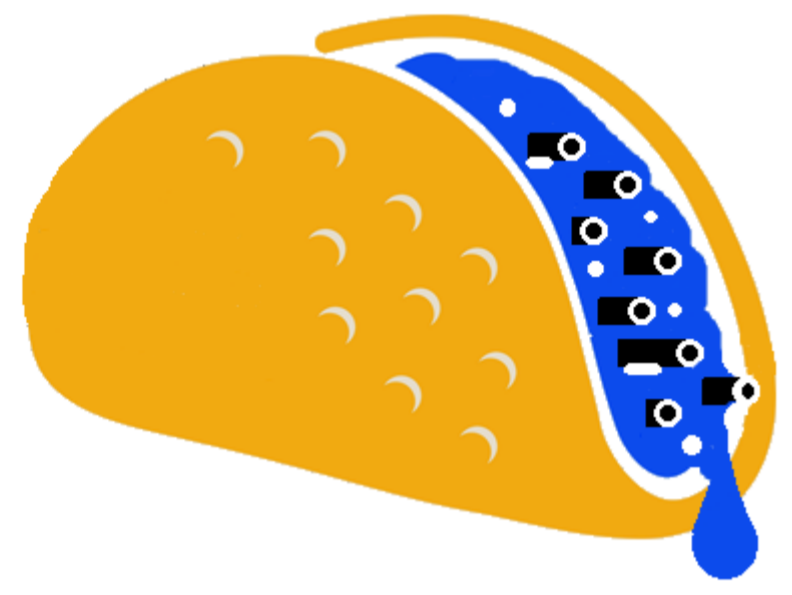


INTERFACE FORMATION MECHANISMS IN FIBRE REINFORCED THERMOPLASTIC TAPES



DUINTACOS



Authors

Rami Alawar¹
Pierre-Jacques Loitier²
Romain Ravel²
Patrick Lenny¹
Monica F. Pucci¹

¹ LMGC, IMT Mines Alès, Univ Montpellier, CNRS (FR)

² PCH, IMT Mines Alès, (FR)

References

[1] J.D. Berry et al. / Journal of Colloid and Interface Science 454 (2015) 226–237

[2] M.F. Pucci et al. / Colloids and Surfaces A: Physicochem. Eng. Aspects 512 (2017) 26–33

[3] M.F. Pucci et al. / Comp Part A 114 (2018) 307-315

Acknowledgement

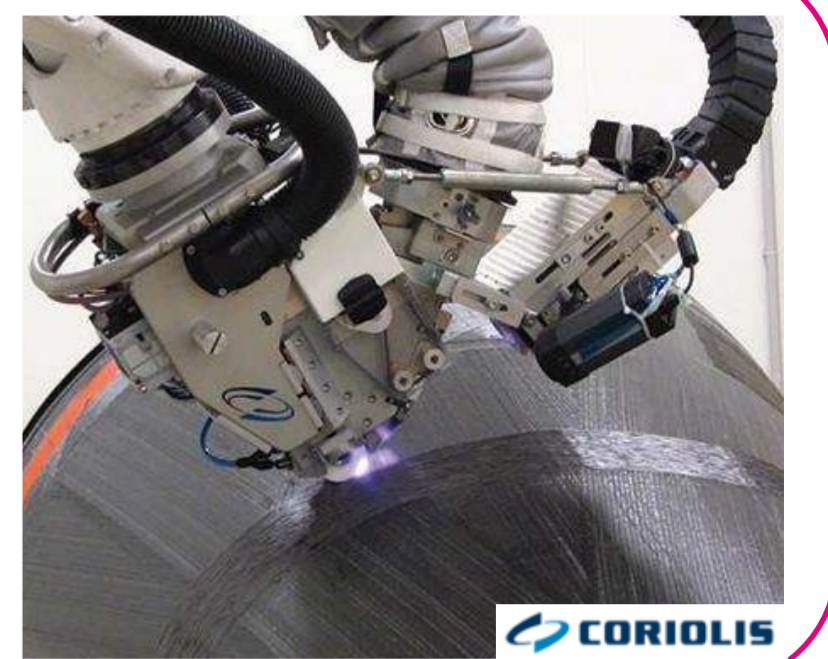
The authors acknowledge the support of the French Agence Nationale de la Recherche (ANR), under grant ANR-23-CE51-0005-01 (DUINTACOS project).

Mines Alès est certifiée par



Context

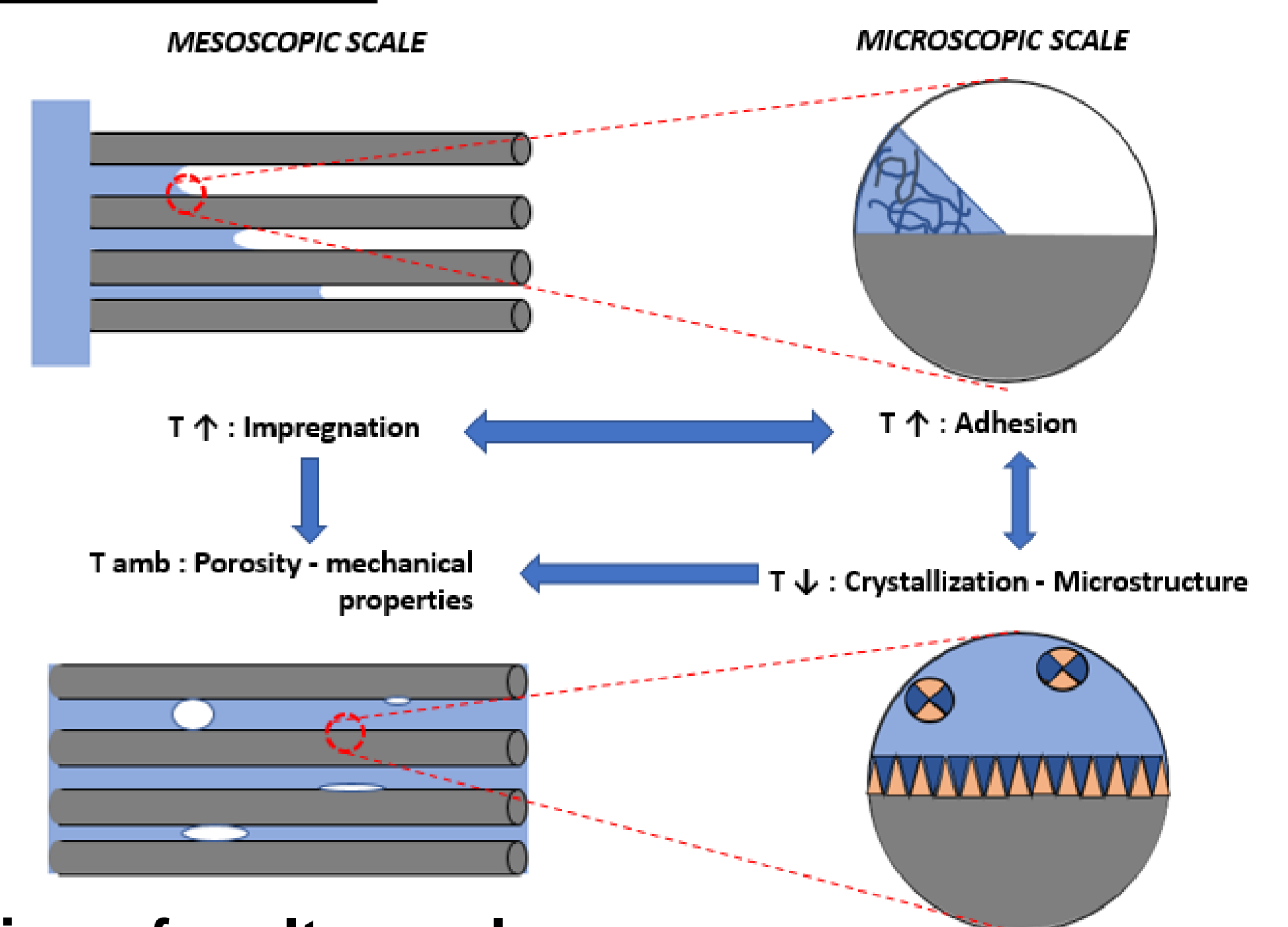
- Obtaining lighter and more complex shape parts, *using sustainable materials and addressing circularity of composites.*
- Using Automated Fiber Placement (AFP), Automated Tape Laying (ATL).
- Manufacturing of **thermoplastic tapes (PEEK, PLA)** reinforced with **high performant, recycled and bio-based fibers (carbon, flax).**



Objectives

- This study is part of **DUINTACOS** project : “**Deep Understanding of INterface formation in fiber reinforced thermoplastic TAPes for high quality COmposite Structures**” (**ANR JCJC**).
- The main objective is to *control the fiber/matrix interface and void formation at micro and mesoscale of the thermoplastic tapes.*
- The following issues will be addressed in our project:

- Deep understanding of the **fiber/matrix adhesion**
- Deep understanding of **impregnation** phenomena
- Deep understanding of **crystallization** phenomena and **microstructure**
- Deep understanding of induced **mechanical properties**

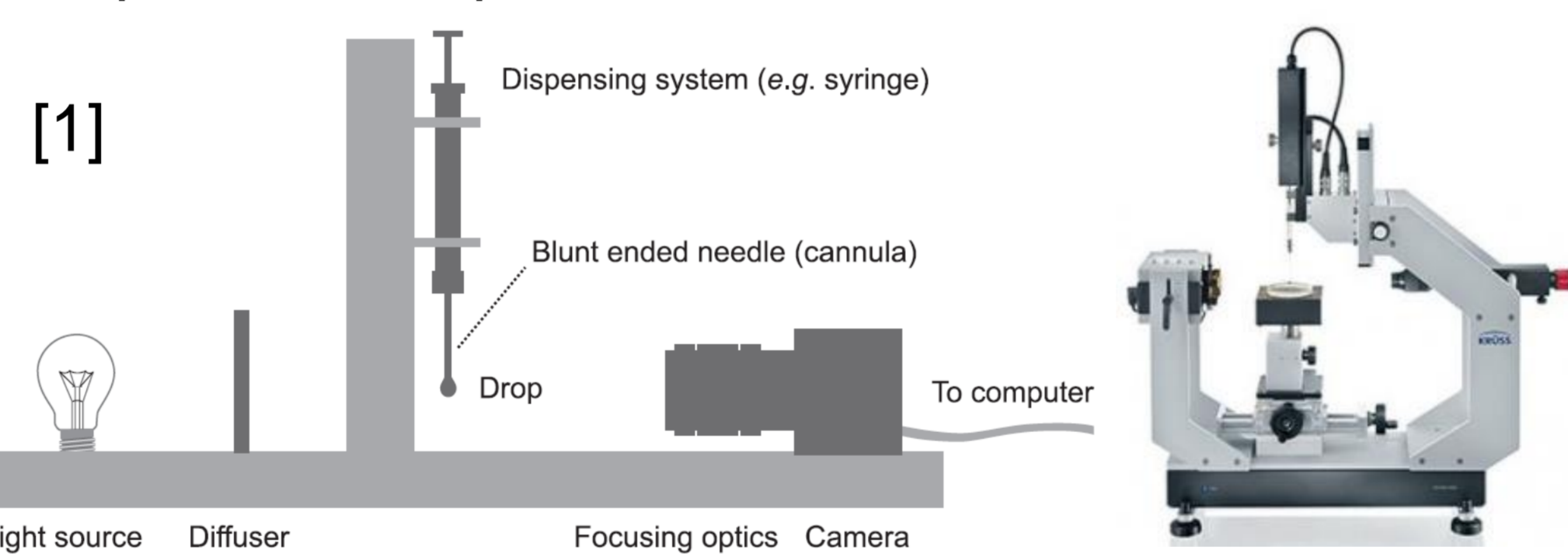


First step : study of surface tension and wetting of molten polymers

Methods

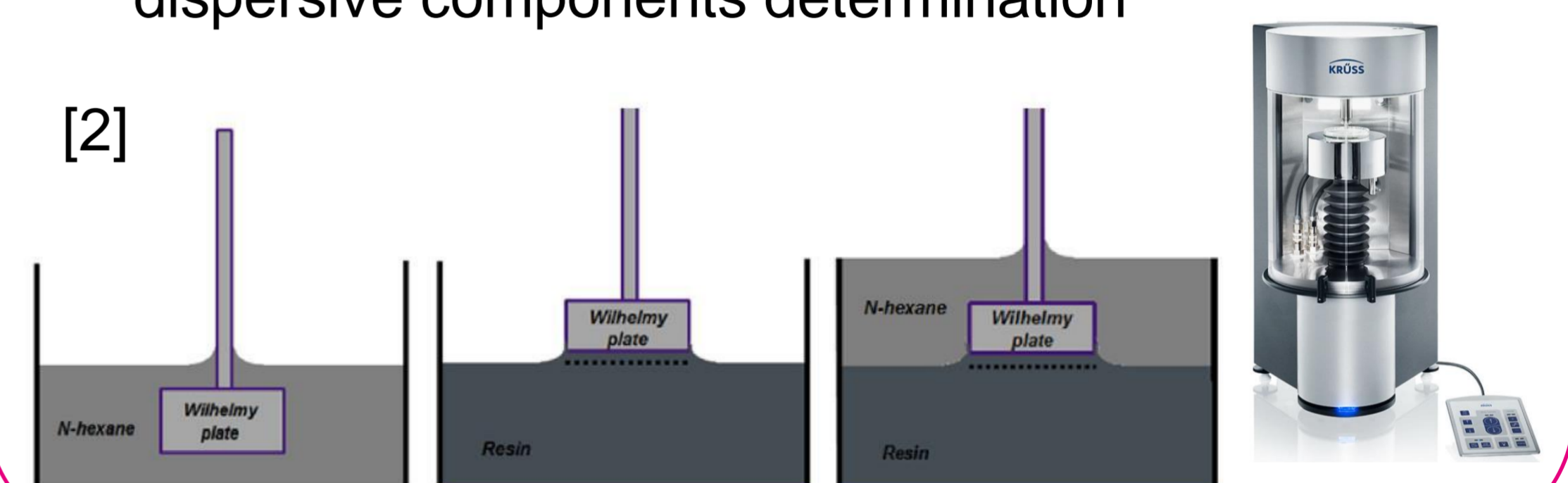
Pendant Drop Analysis

- Krüss Drop Shape Analyzer DSA 30 is used for:
- Liquid's surface tension vs temperature (**up to 400°C**)
- Interfacial tension vs temperature, for polar and dispersive components determination



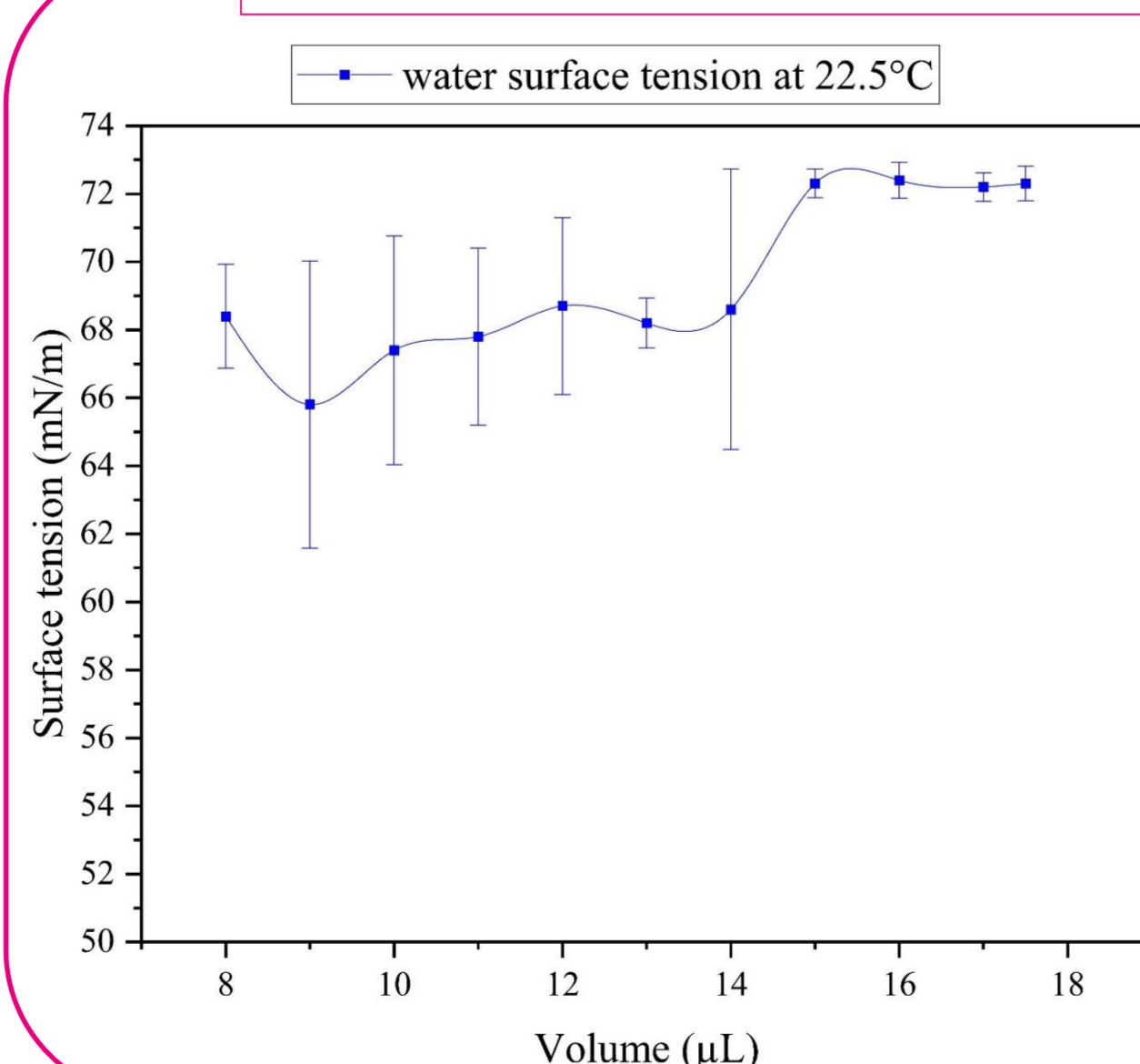
Tensiometric Analysis

- Krüss Tensiometer K100 SF is used with Wilhelmy plate for:
- Liquid's surface tension vs temperature (**up to 200°C**)
- Interfacial tension vs temperature, for polar and dispersive components determination

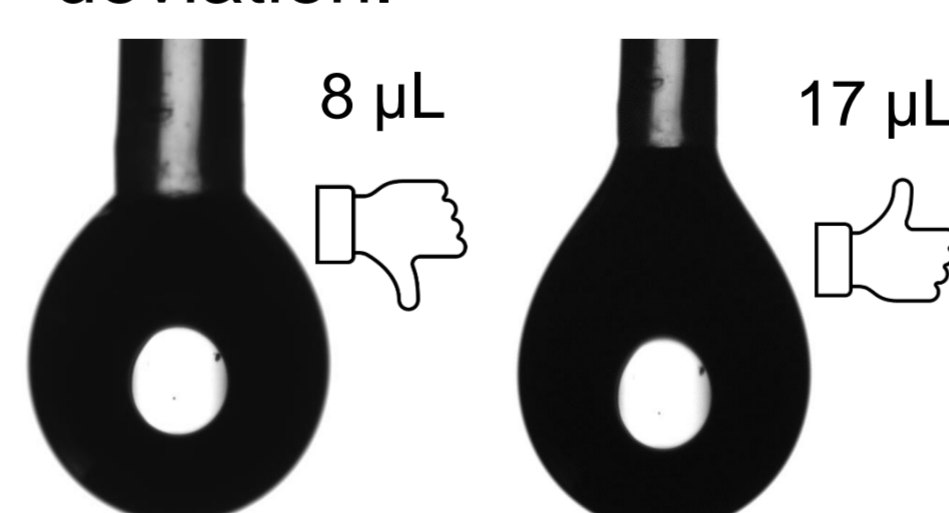


Primary Results

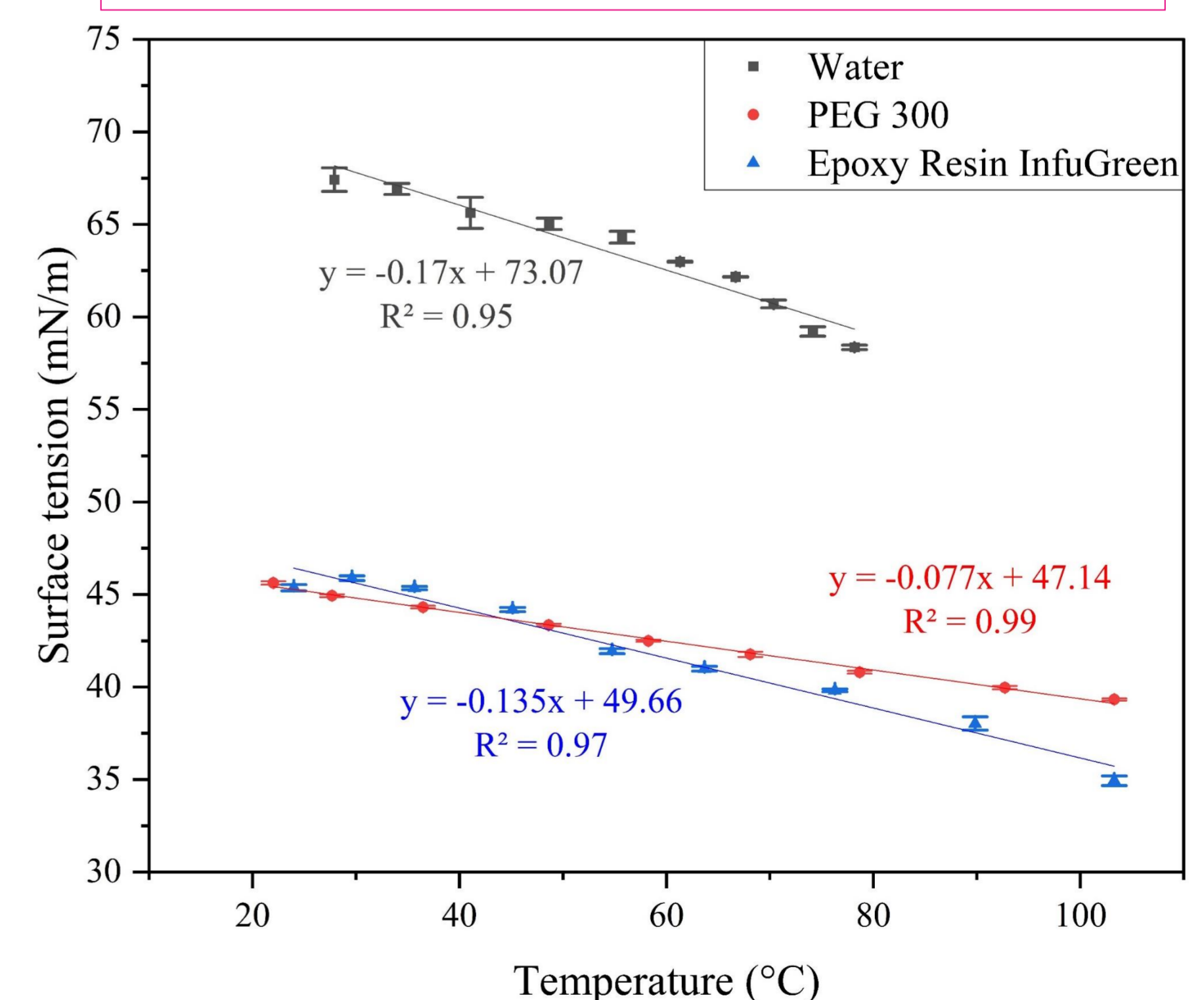
Volume drop effect on surface tension



- At 22.5°C $\gamma_{water}^{th.} = 72.67$ mN/m
- Small volume results in low accuracy, maximum one gives high accuracy and low deviation.

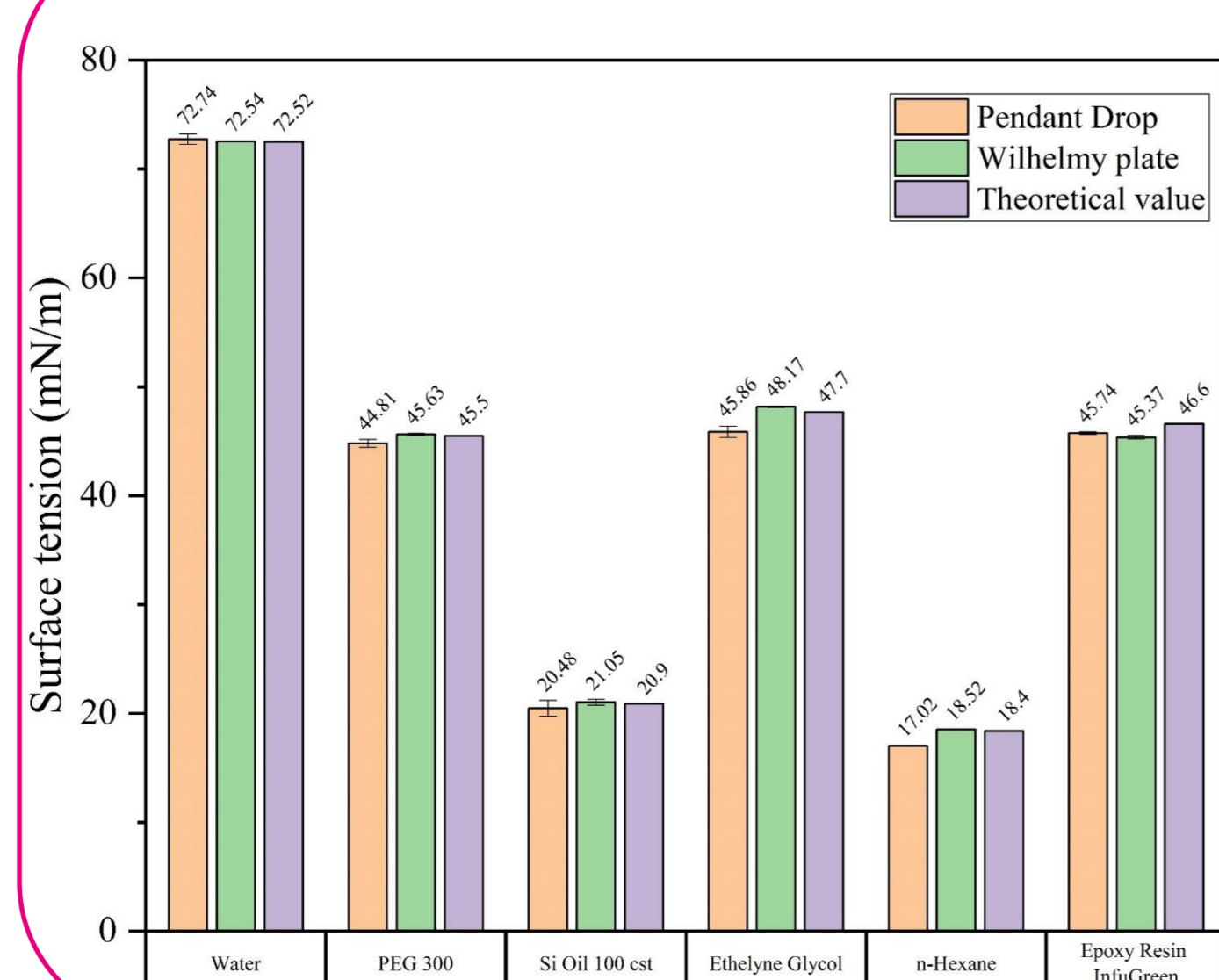


Surface tension vs temperature



- Three tests for each temperature were performed with tensiometer.
- Surface tension decreases linearly as the temperature increases, in accordance with Eötvös law [3].

Comparison between methods



- Results were obtained at room temperature.
- They are reliable using Pendant drop and Wilhelmy methods.
- Theoretical values are from a previous work of M.F. Pucci et al. [2].

Conclusions and perspectives

Reliable methods will be used to study wetting of molten polymers on fibers used for tapes manufacturing.