POLYTECH CLERMONT-FERRAND

INSTITUT PASCAL sciences de l'ingénierie et des systèmes

**l'école d'automne du GdR**
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# Effect of reinforcement ratio and textile Pre-impregnation on the Mechanical behavior of FRCM


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# 1. Context & Factors affecting the Mechanical behavior of FRCM

## Context

**Mineral Matrix**

Transmission of forces to the reinforcement and protection of the external environment

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**Continious Fibers**

Support of mechanical forces

- High tensile resistance
- Compatibility with substrates
- Easy to implement …

[Hegger al., 2005];[Cevallos al., 2015]; [Giuseppe et al., 2021]; [Homoro et al., 2019]; [Pelled et al., 2008]; [Triantafillou et al., 2016];…

**Matrix**

- Mechanical and chemical properties of the matrix
- Type of mineral matrix

**Composite**

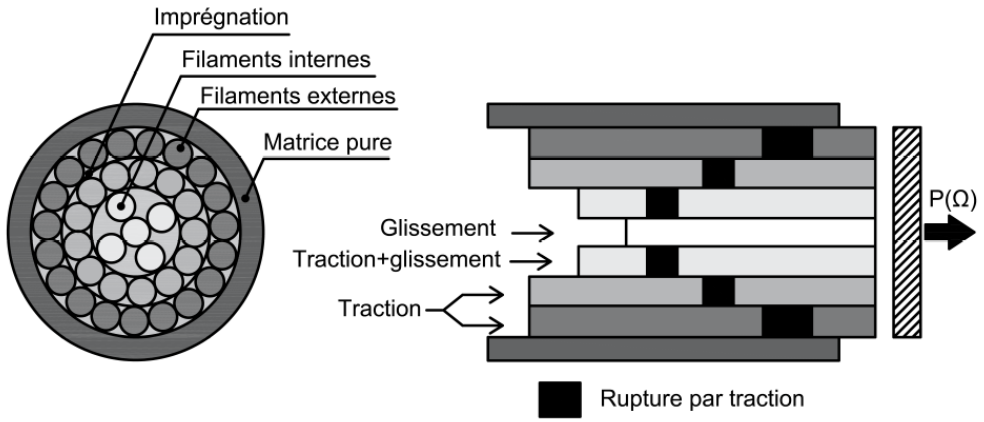
- Adhesion between Textile and Matrix
- Reinforcement ratio
- Fabrication technique

**Textile**

- Mechanical properties of textile
- Fabric Geometry
- Fibers arrangement and orientation

# 2. Weak adhesion Problematic & pre-impregnation techniques

## ❖ *Adhesion Problematic*




**Problems** → Weak adhesion between cementitious matrix and inner filaments

[Banholzer, 2004]; [Saidi Mohamad, 2020]

**Solutions**

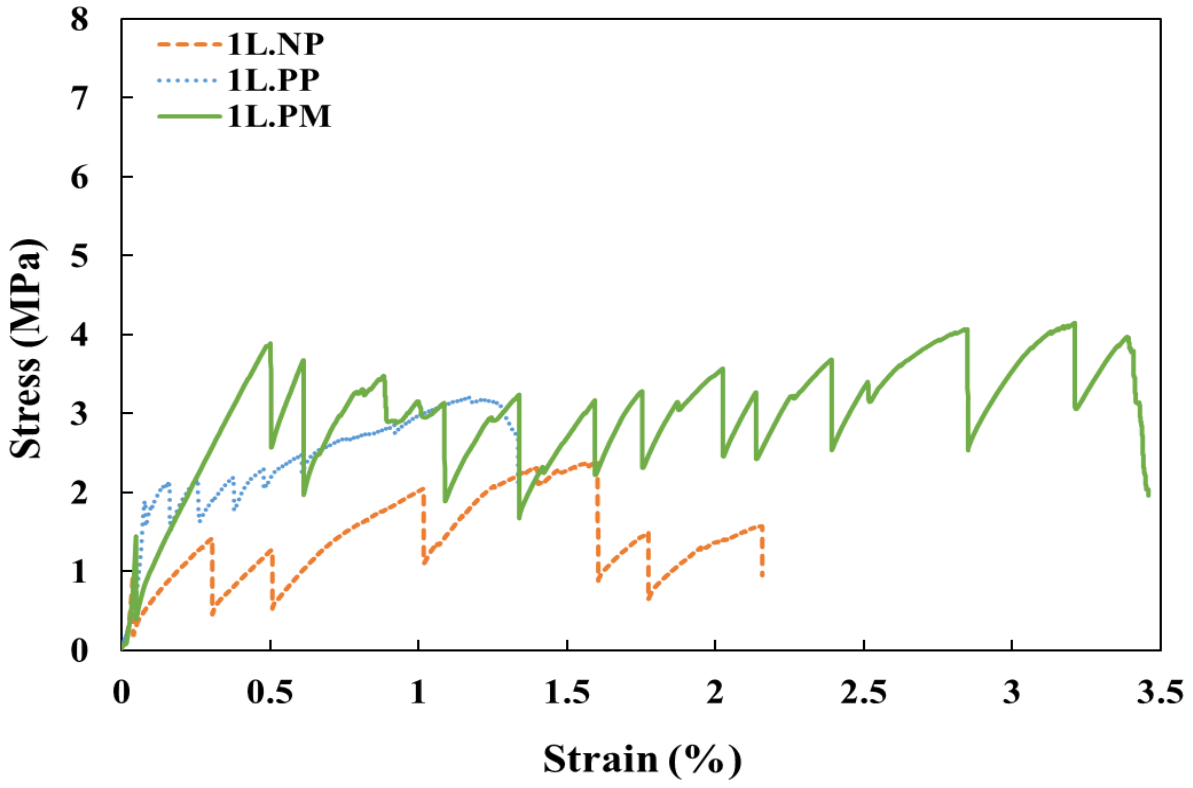
**PP : Polymeric Pre-impregnated Textile**

**PM : Matrix Pre-impregnated Textile**

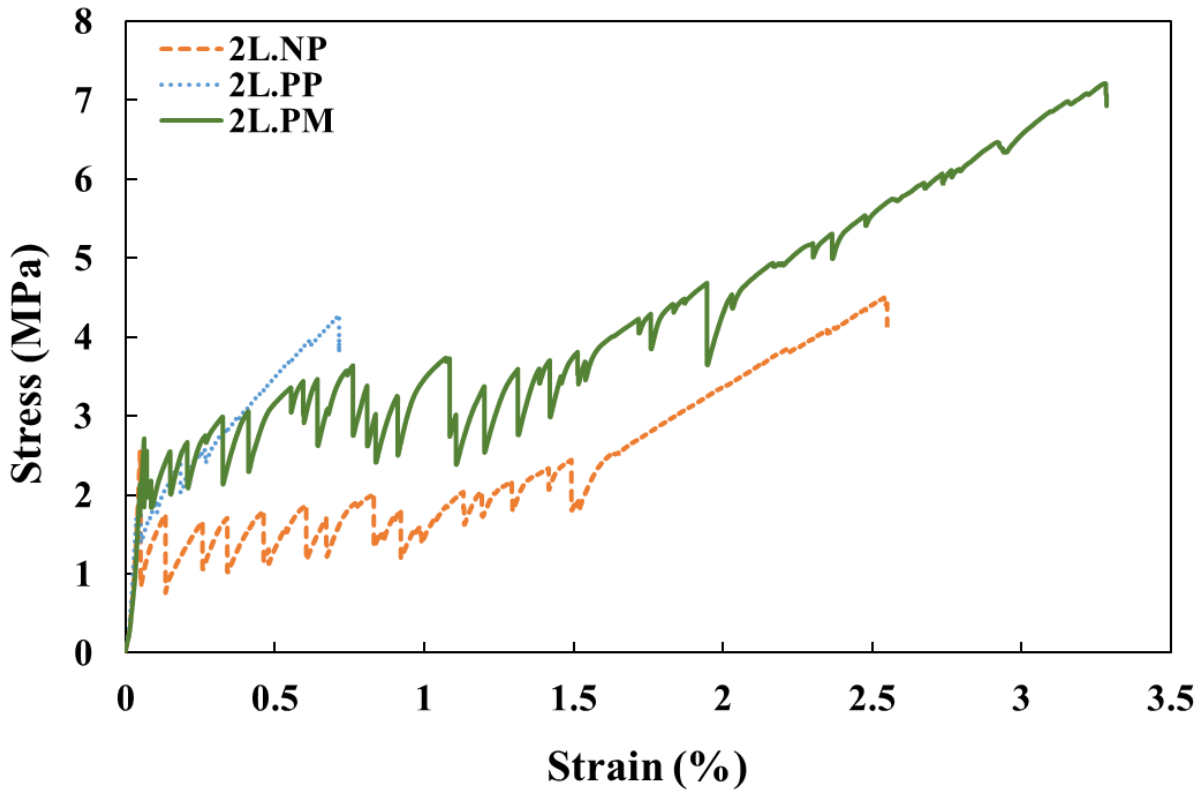
**Two Reinforcement Rates : 1L FRCM Composites (1 textile layer)**
**2L FRCM composites (2 textiles layers)**

# 3. Mechanical behavior of FRCM

## 1L FRCM composites

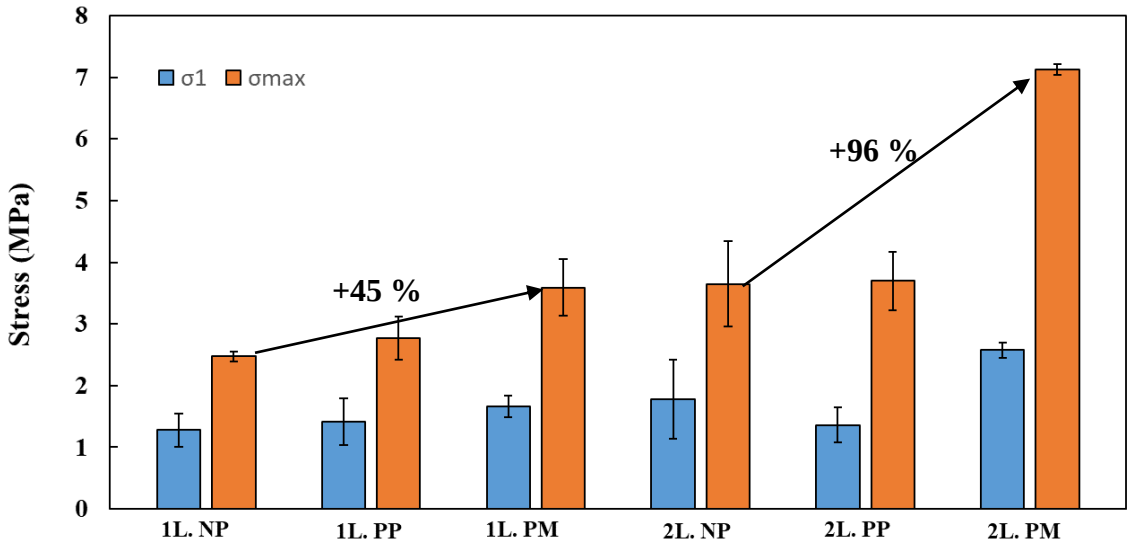


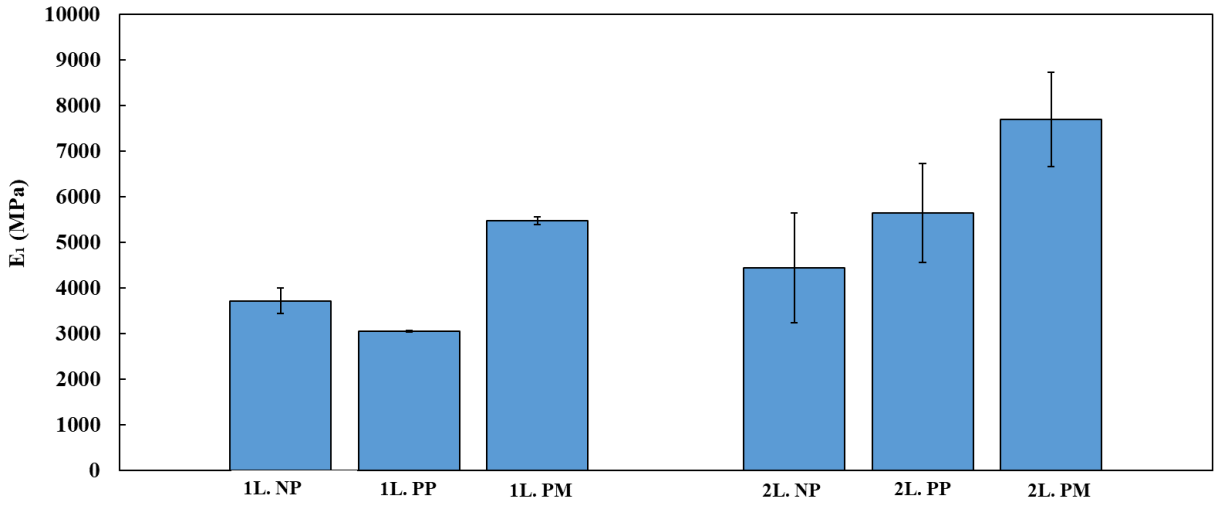

## 2L FRCM composites




**NP** : Non-Pre-impregnated Textile (reference); **PP:** Polymeric Pre-impregnated Textile ; **PM:** Matrix Pre-impregnated Textile

# 4. Mechanical Properties of FRCM




- **Gain of 45 % and 96 % in σmax for PM configuration => Best configuration**
- **Mechanical Strength increase as Reinforcing ratio increase**

**NP** : Non-Pre-impregnated Textile (reference); **PP:** Polymeric Pre-impregnated Textile ; **PM:** Matrix Pre-impregnated Textile

**Rafik Bardouh, Omayma HOMORO, Sofiane Amziane. Effect of textile Pre- impregnation and reinforcement ratio on the mechanical behavior of flax FRCM Composites. Paper submitted on July 2022 to "Materials and structures"**