DEVELOPMENT OF A SELF-HEALING INTERPHASE FOR STRUCTURAL COMPOSITES

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FULL PAPER

SCAN ME

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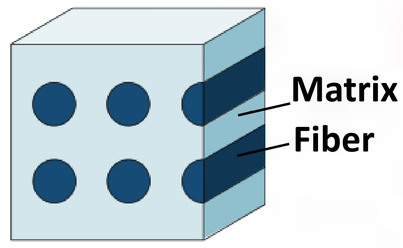
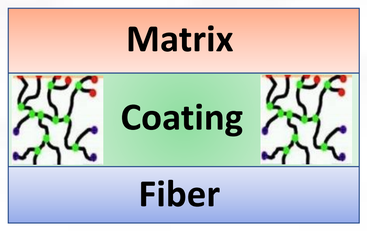
INTRODUCTION

- Fiber-reinforced polymer composites: matrix + fibers, separated by the **interphase** where the two phases interact, dictating the **properties of the final component**.
- **Self-healing interphase:** interphase able to **restore** the interactions between the two phases if subjected to heat.
- The healing process **extends the service life of the composites.**
- **Aim of the work**: development of a **coating** for glass fibers made of **Polycaprolactone (PCL)** to provide the healing of the interphase with an epoxy matrix. The glass fibers are provided both with and without the compatible superficial sizing.

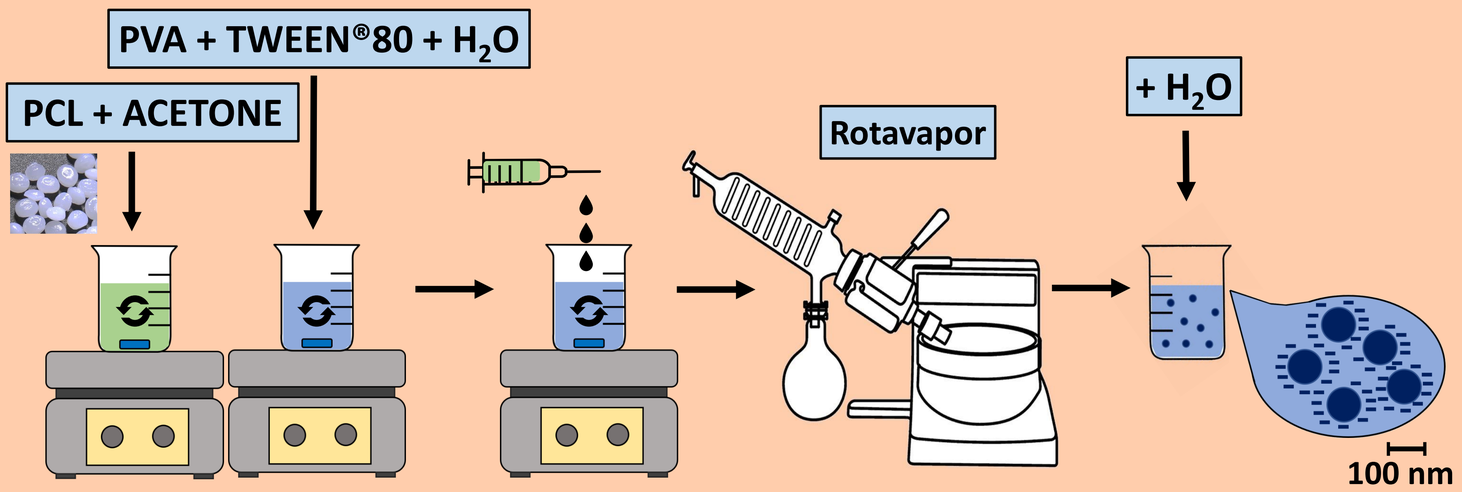




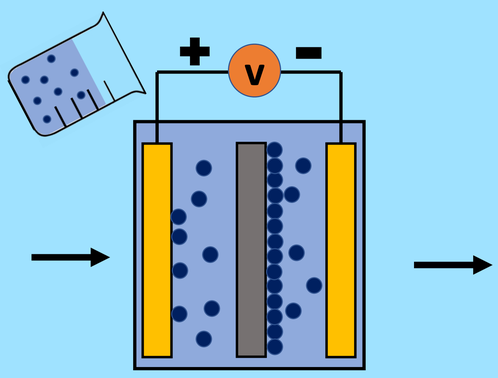
EXPERIMENTAL

Solvent displacement technique (PCL solution preparation)

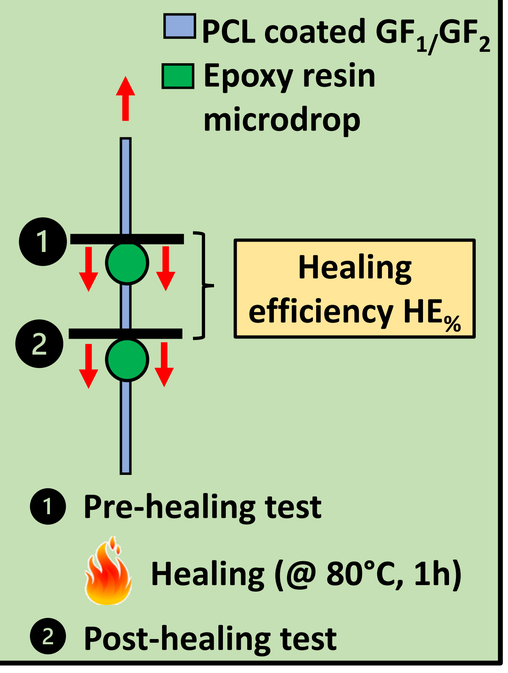
Adapted from Badri et al.



Electrophoretic deposition (Glass Fibers PCL Coating)

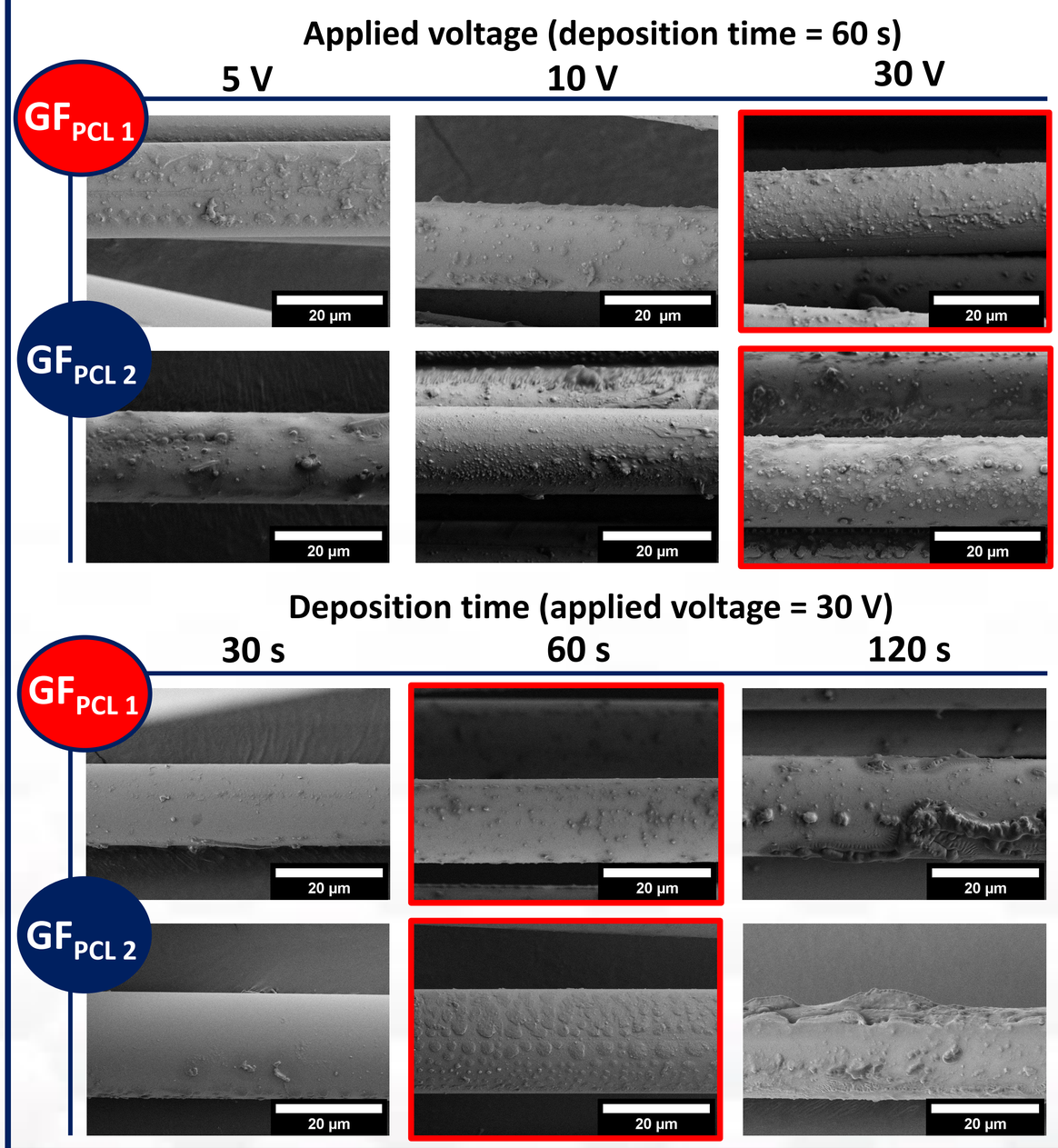


Microdebonding test (interphase testing)

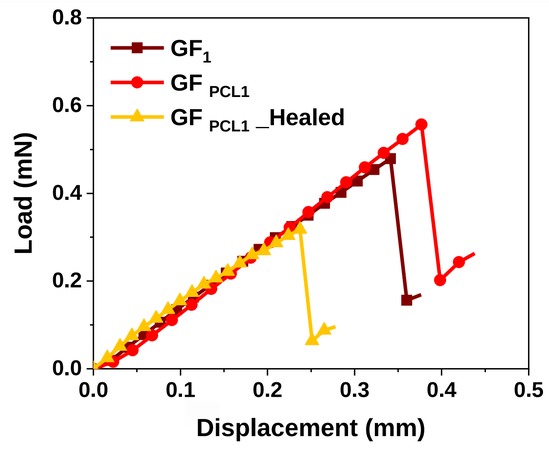


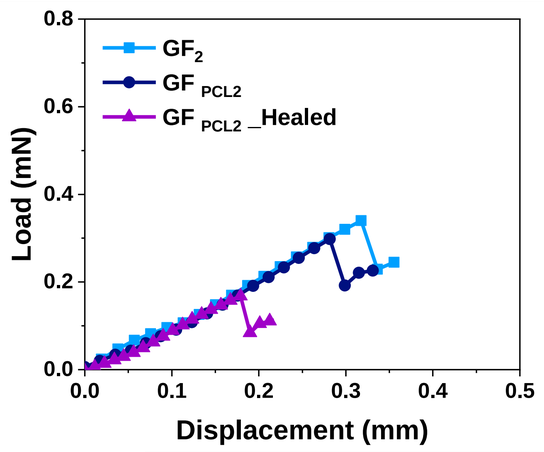
RESULTS

Morphological analysis (FESEM) of PCL coated GF_1 / GF_2



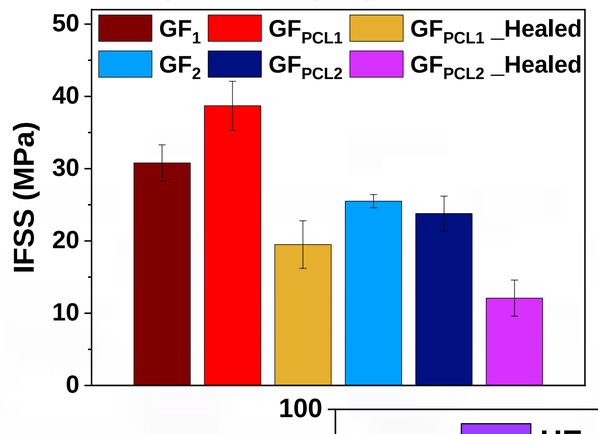
Mechanical (microdebonding) analysis of PCL coated GF_1 / GF_2 (30V, 60s)





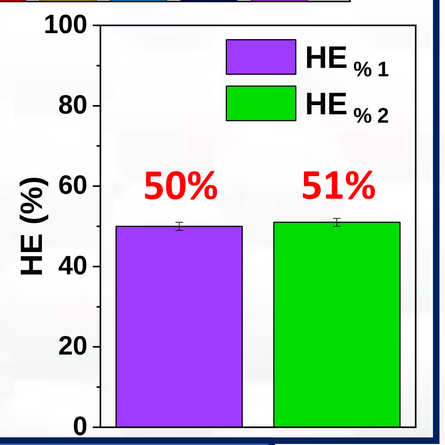
Interfacial shear strength (IFSS)

$$IFSS = \frac{F_{max}}{\pi d L}$$



Healing efficiency ($HE_{\%}$)

$$HE_{\%\,(1,2)} = 100 \cdot \frac{IFSS_{\,PCL\,(1,2)\_Healed}}{IFSS_{\,PCL\,(1,2)}}$$



CONCLUSIONS

PCL nanoparticles deposition on the glass fibers surface provides **homogeneous and high-quality coatings** that allow a **50% recovery of the initial mechanical properties of the composites** (in terms of interfacial strength, IFSS), delaying the end of life of the component. The presence of the compatible silane sizing does not influence the healing mechanism.

REFERENCES

- Badri et al., *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 2017.
- Jones et al., *ACS Appl Mater interphases*, 2014.
- Mahmood et al., *Applied Sciences*, 2021.
- Da Silva et al., *Handbook of Adhesion Technology*, 2018.