**Advanced Polymers Unit**| APPLIED CHEMISTRY & MATERIALS GROUP
**Leitat Technological Center**

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# The EIROS Project

**NOTE: Information showed is strictly non-confidential from projects supported by public funding**

# 01. **Introduction and Objectives**

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***EIROS*** → **Erosion and Ice Resistant cOmposite for Severe Operating conditions.**
(www.eirosproject.com)

**Objective: To develop a range of ice and erosion resistant composite materials based on a resin system containing micro-particles that add functionality (Self-Healing, anti-icing,..) to components in extreme environments.**


Applications

**This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 685842**

# 02. **Execution**

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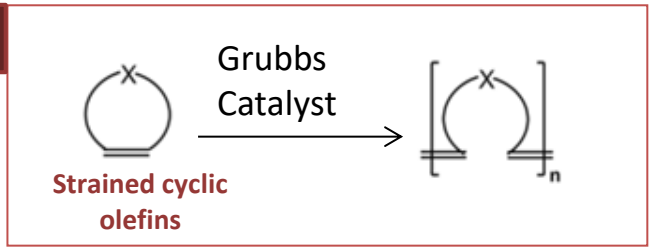
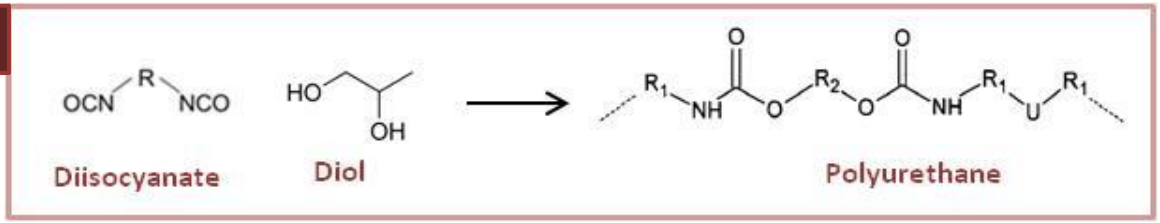
## *Self-healing systems suitable for extremely low temperatures:*

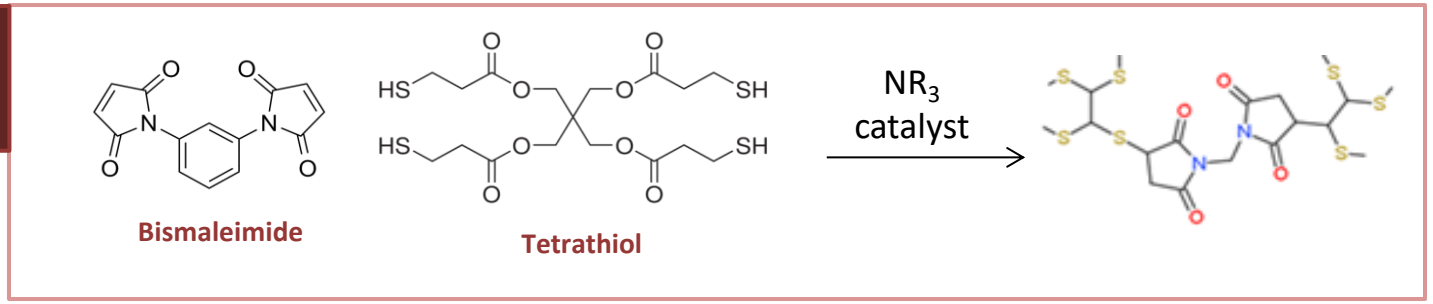
### 1. ROMP system




### 2. PU system




### 3. Bismaleimides and polyfunctional-thiols

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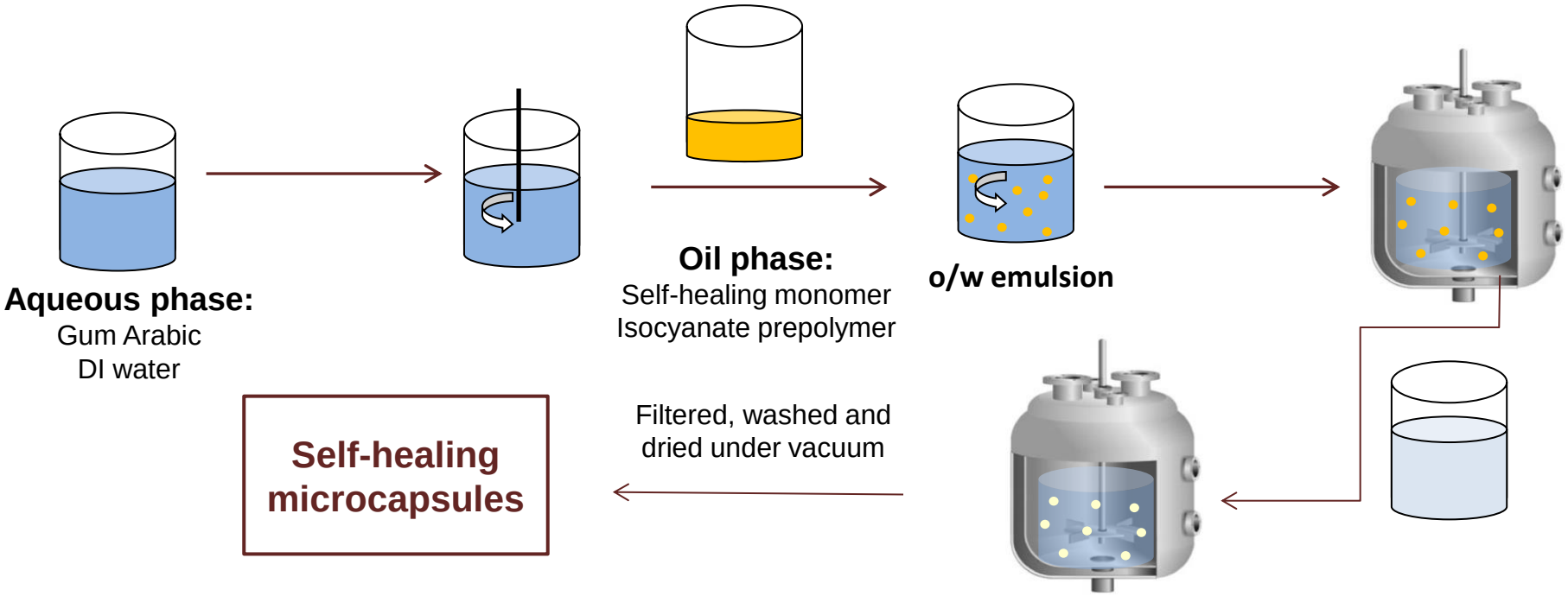
# *Encapsulation of self-healing monomers:*

## **Interfacial polymerization** encapsulation technique:

- Alternative encapsulation strategy to poly(urea-formaldehyde) or poly(melamine-formaldehyde)
- Polyurea shell to encapsulate Self Healing monomers
- Selection of **solvent-free** and commercial pre-polymers for the shell (to avoid the use of additional VOCs)
- Capsules of ≈15 µm
- Characteritzation: Mastersizer, FT-IR, SEM, TGA, DSC and Nanoidentation

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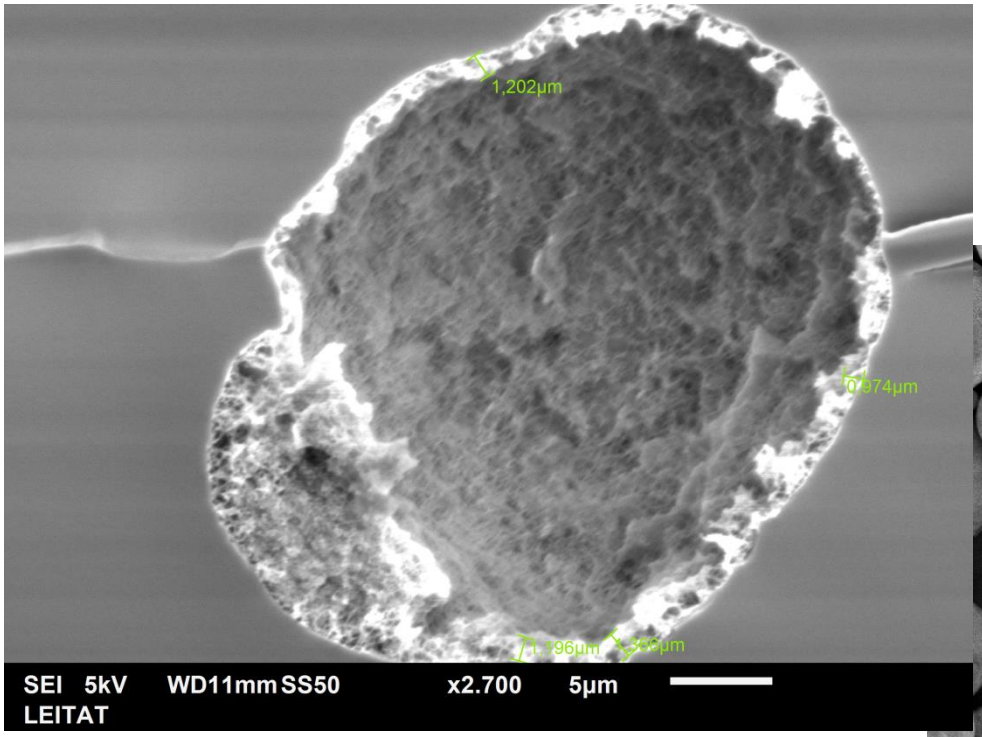
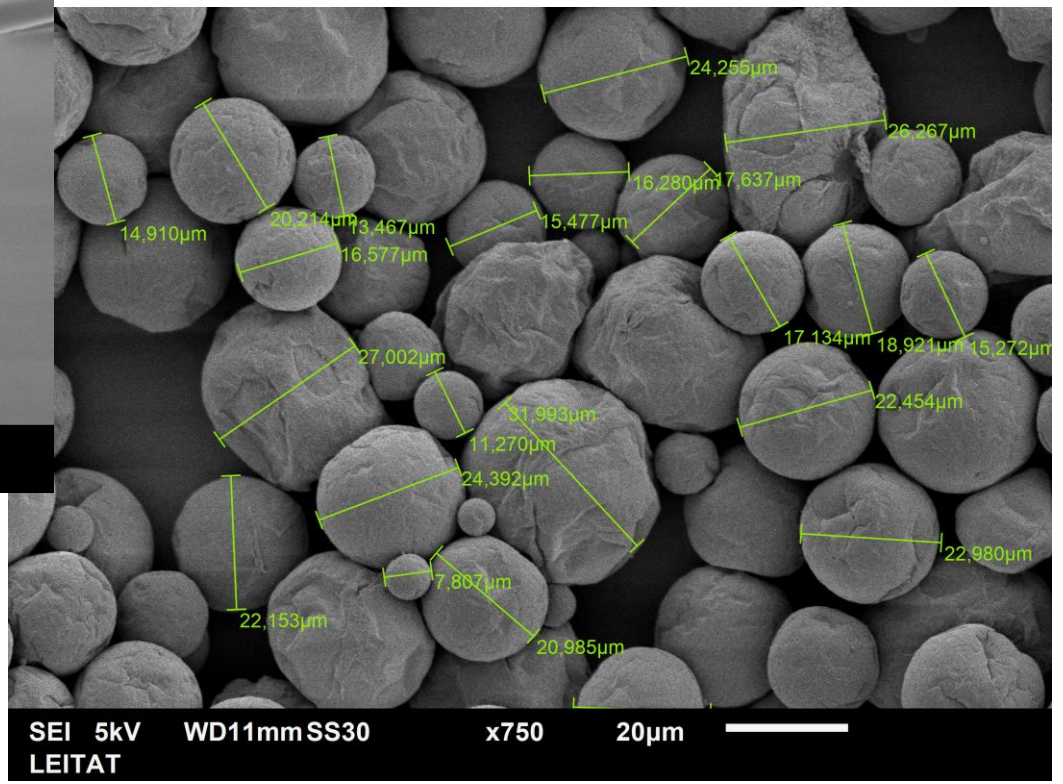
SEM images of Self-Healing Capsules structure and morphology

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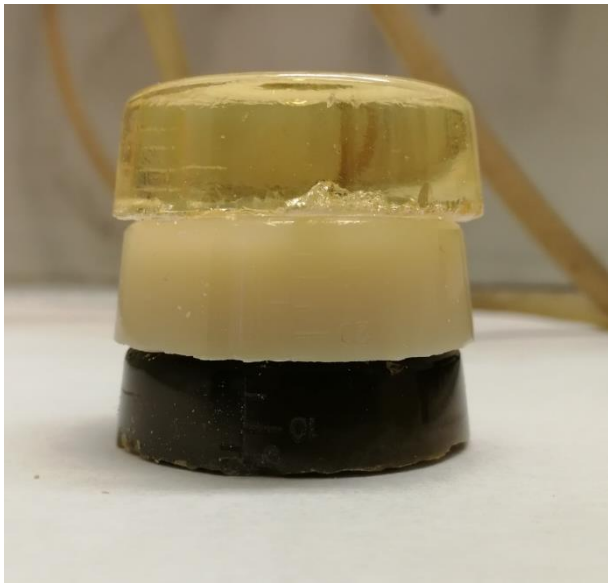
## Dispersion process

**Neat Resin**

**Resin Loaded with SH MC**

**Resin Loaded with SH and catalyst MC**



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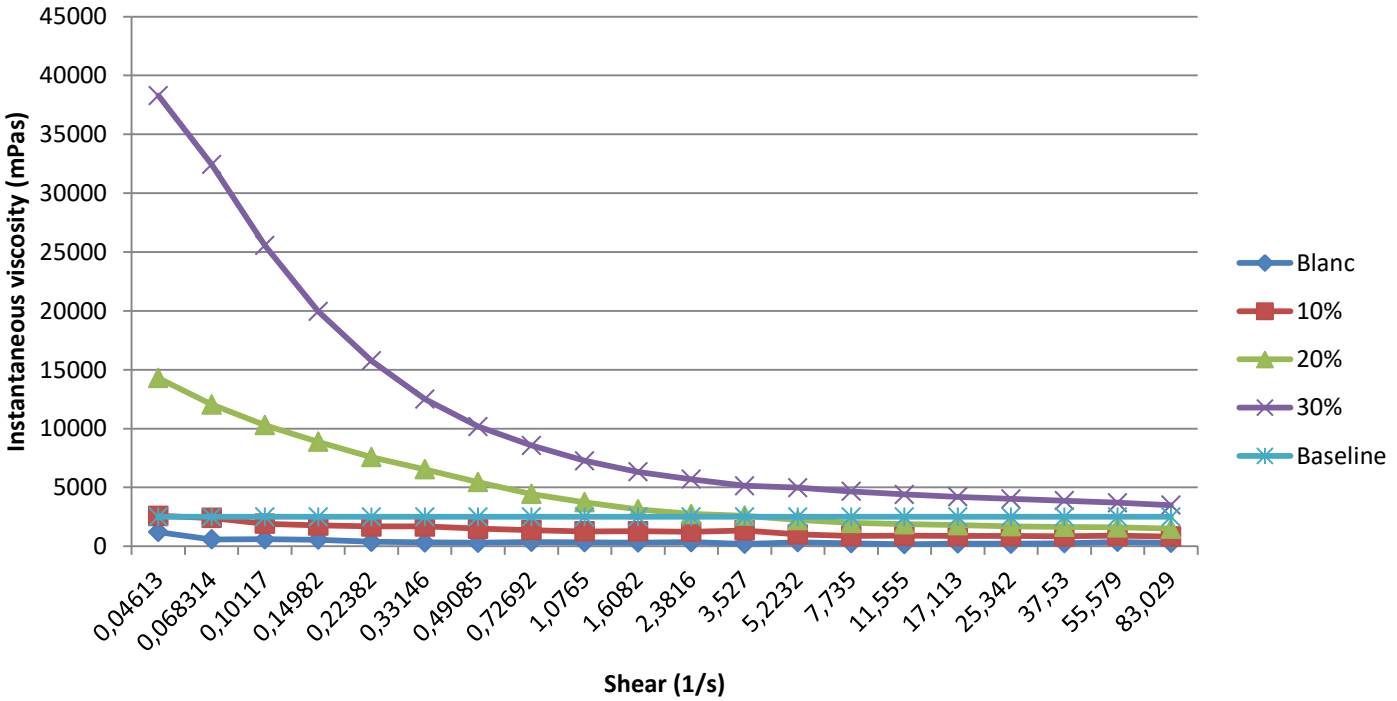
## Dispersion process

### Dispersed material:

- 10, 20 and 30 wt% of Self-Healing microcapsules (15 - 20 µm)
- 1 wt% of Grubbs' catalyst paraffin capsules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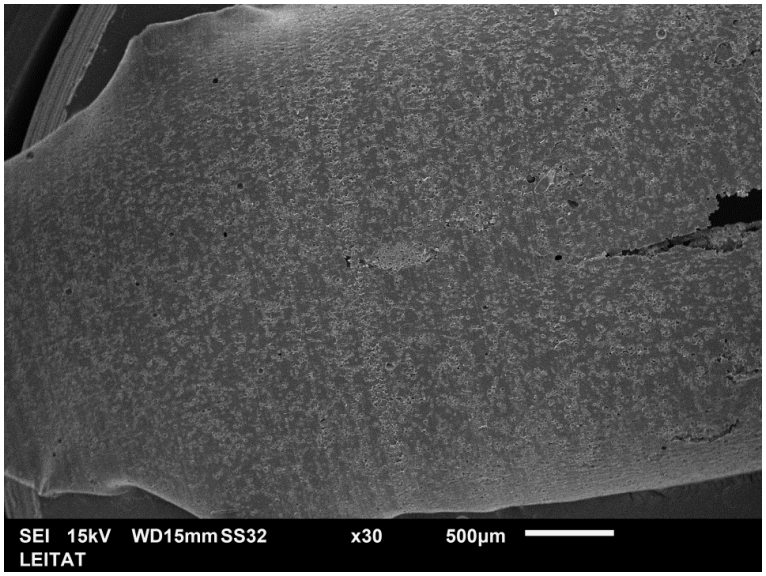
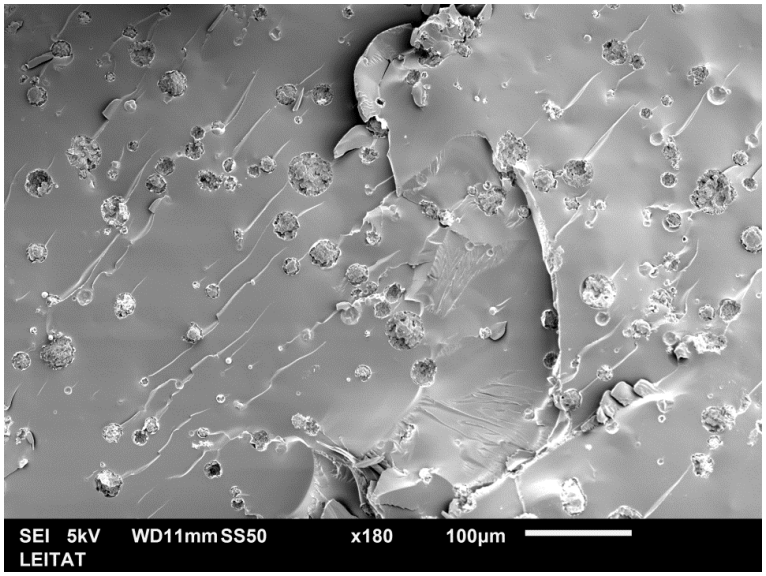
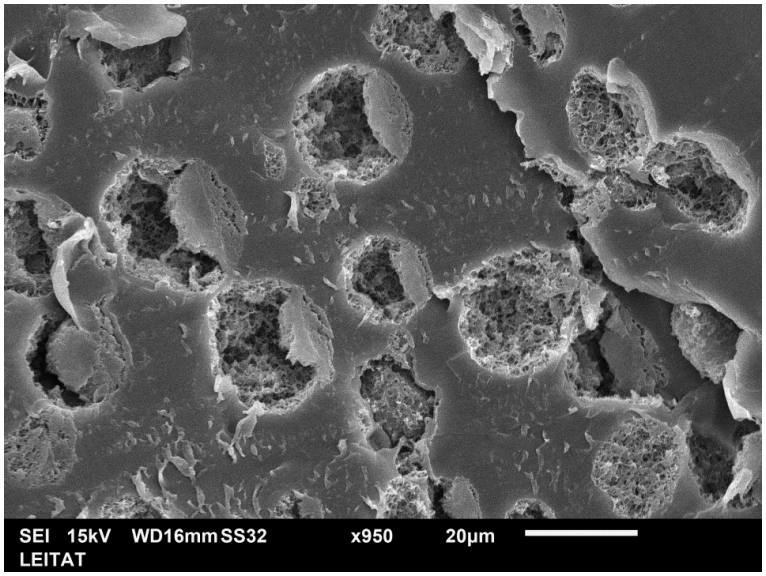
# 02. Execution| EIROS

- SEM images ofSelf-Healing Microcapsules Dispersion in Different case-studies resins

- Homogeneous dispersion in all resin volume

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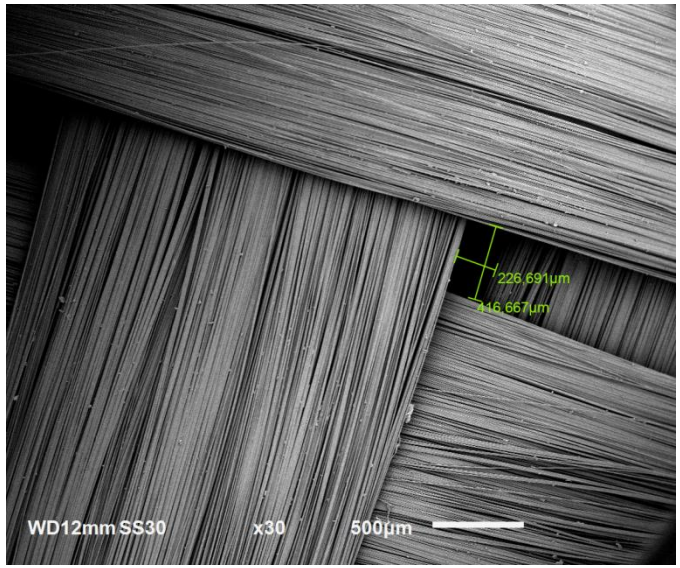
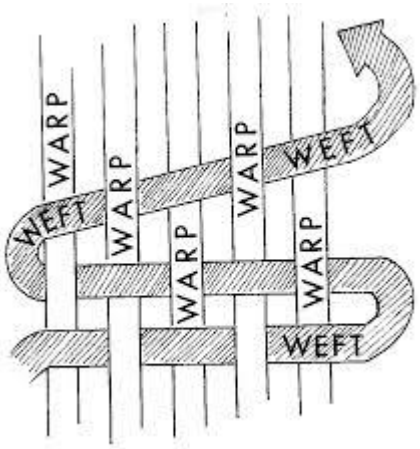
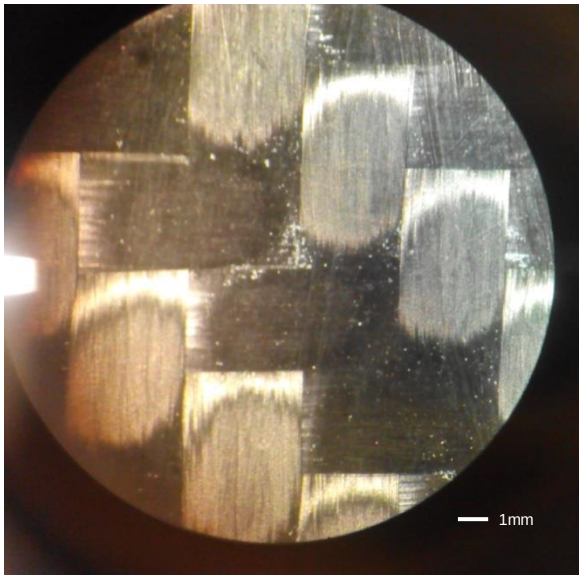
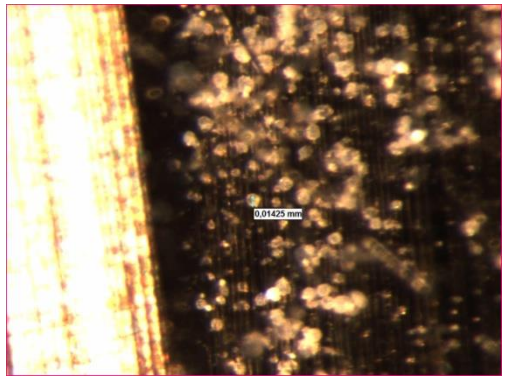
- Optical images of Self-Healing Microcapsules Dispersion in Composite Panel

- Particles acumulation in the Warp and Weft of the Carbon Fiber



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# 03. **Future Steps**

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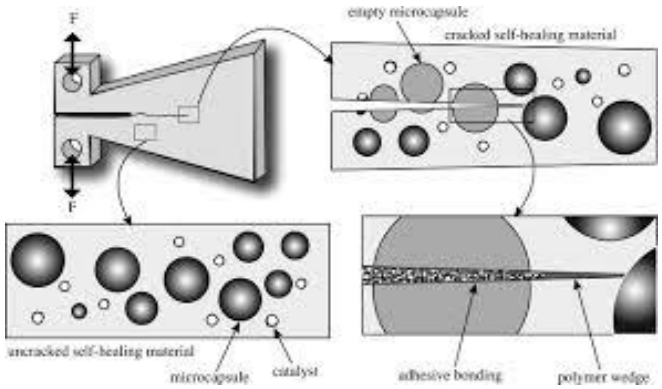
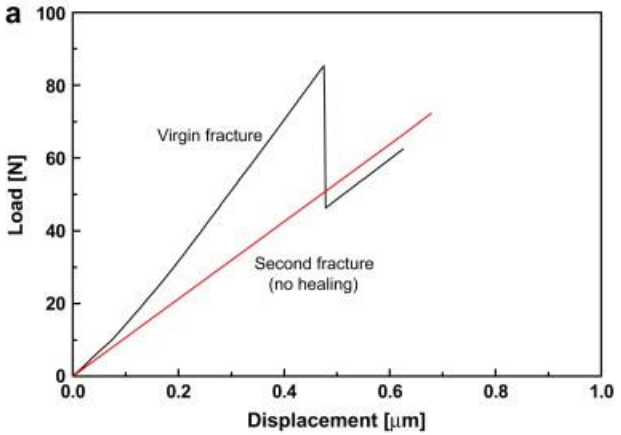
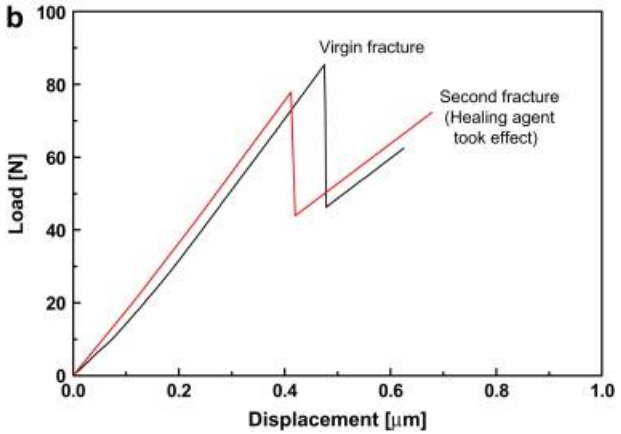
## *Self Healing Test for TDCB specimens*

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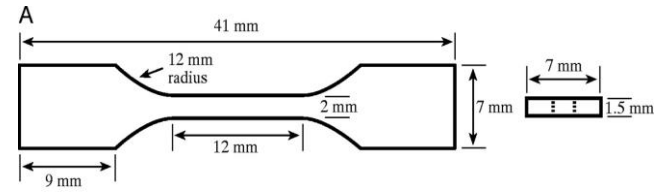
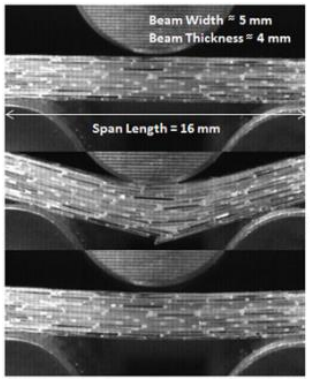
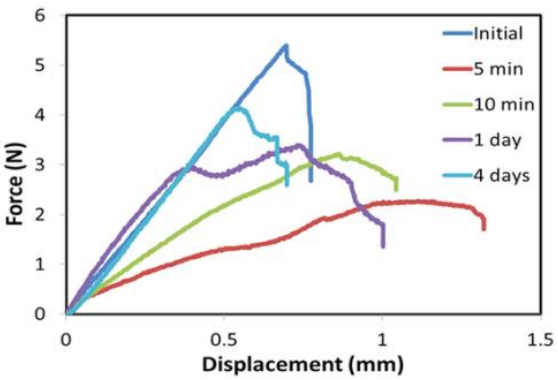
## *Material Properties Characterization*

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# 04. **Conclusions**

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- Optimal monomer mobility and Reactivity has been obtained at very low temperatures (-20 ºC, -50 ºC and -70ºC)

- Monomer diffusion and degradation during curing processes has been prevented through Microencapsulation

- Good Composite homogenization, compatibility and accomplishment of viscosity requirements

- First composite material synthesis with promising results

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# Thanks for your attention!


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