

# Nanomodified reshapeable, repairable and recyclable epoxy resin for conducting composite materials

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Thermoset resins due to their high thermal stability, good rigidity, hardness and resistance to creep and solvents are the most widely used resins in fibre reinforced composite manufacturing. In addition, epoxy resin systems provide strong adhesive properties, chemical resistance and toughness as well. But a traditional thermoset composite cannot be reshaped, repaired neither recycled due to its permanently cross-linked structure. To overcome such limitations, a novel 3R (Reshape-able, Repair-able and Recyclable) epoxy matrix was developed by Odriozola et al. which is based on dynamic covalent bonds (Figure 1)<sup>1</sup>. The 3R epoxy resin offers mechanical properties equivalent to traditional epoxy counterpart, but additionally presents: (i) good reprocessability of postcured composites by thermoforming, (ii) reparability of delamination and micro-cracks by applying heat and pressure in the damaged part, and (iii) recyclability by matrix chemical dissolution with specific reagents or by grinding and mechanical processing into second generation composites.

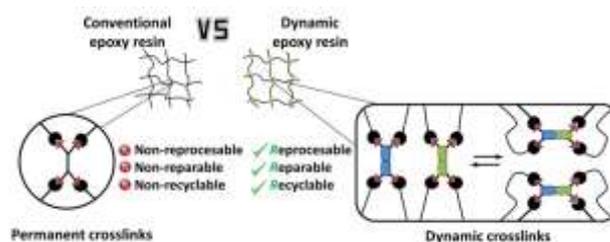
The aim of this work is to develop a novel 3R epoxy resin with enhance thermal conductivity to be implemented in thermoelectric generation (TEG) enabled composites within HARVEST project ([www.harvest-project.eu](http://www.harvest-project.eu))<sup>2</sup>. As any typically polymer resin, 3R system is a good thermal insulator and presents very low thermal conductivity. Therefore, here the addition of nanoparticles such as carbon nanotubes (CNT) and carbon black (CB) into the resin

has been explored in order to facilitate the heat transportation in the system.

## References

- [1] Ruiz de Luzuriaga et al. Mater. Horiz., 3 (2016) 241-247. Odriozola et al. WO 2015181054 A1
- [2] This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 769140.

## Figures



**Figure 1:** Schematic representation of a conventional thermoset resin network vs the dynamic thermoset network