

# Carbon based materials in epoxy resin composites for self-heating applications

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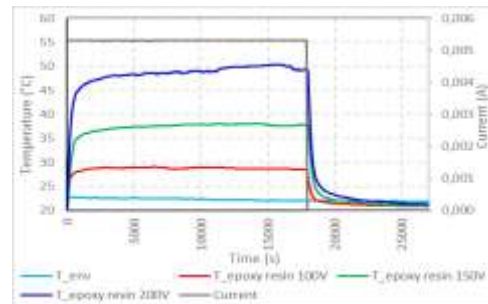
## Abstract

This research studies the feasibility of an epoxy resin composite incorporating carbon based materials as a self-heating material for preventing ice-formation and de-icing applications (automotive, aeronautic and wind energy sectors). Carbon based materials may provide electrical conductivity when incorporated to polymeric matrices (i.e. epoxy resins, typically insulating materials) and are responsible of the Joule effect (the heat release of a material due to the movement of electrons when applying an electrical voltage), therefore providing materials with intelligent and self-responsiveness properties, such as self-heating.

In this work, self-heating capacity of epoxy resins containing carbon-based materials has been evaluated for preventing ice-formation and de-icing applications. Tests for characterization were carried out in laboratory conditions with fixed voltages of

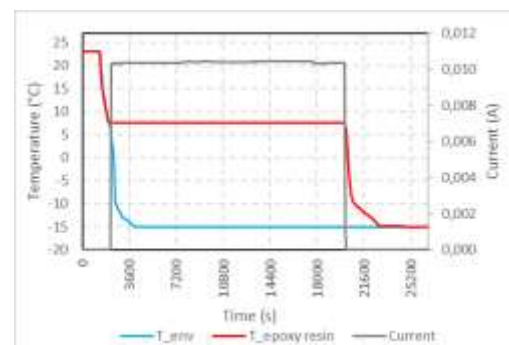
## References

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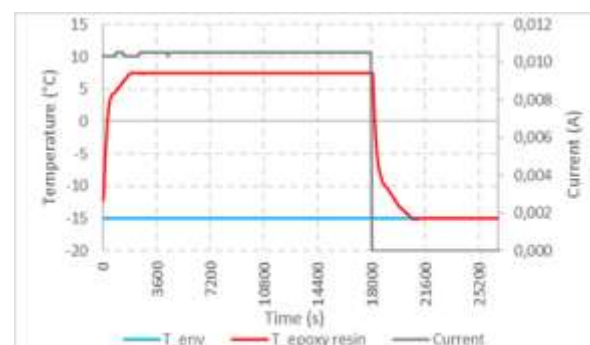


**Figure 1.** Laboratory conditions tests performed at different fixed voltages.

100, 150 and 200V DC. After that, prevention of ice-formation and de-icing tests were performed at -15 °C with a fixed voltage of 200 V DC. Results showed that carbon-based materials can increase the epoxy composites temperature up to 6.8 °C, 17.7 °C and 30 °C, respectively for the aforementioned voltages, in laboratory conditions, and up to 7.5 °C with an environmental temperature of -15 °C, and 200 V DC fixed voltage.



**Figure 2.** Ice-prevention test performed at 200V DC fixed voltage.



**Figure 3.** De-icing test performed at 200V DC fixed voltage.