Graphene-based composites for thermal management applications

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Abstract

The superb thermal conduction of graphene establishes it as an excellent material for thermal management. With the increase of power densities in electronic devices together with the continuing trend of reduction in device dimensions there is a need for novel materials to design appropriate thermal management systems to ensure electronic devices operate within their specification.

Tecnalia has developed Graphene based composites for potential applications where more efficient thermal dissipation materials are needed. Two potential applications have been addressed: Thermal Interface Materials (TIMs), such as thermally conductive adhesives and lightweight high performance CFRP composite parts with conductive properties.

1. Thermally conductive adhesives based in graphene. Commercially available conductive adhesives contain high concentrations of metallic particles resulting in high viscosities. Instead, the use of nanoparticles with good thermal properties helps in obtaining high conductivities with lower percentages of filler materials. This work compiles the development of graphene based thermal interface materials (TIMs). The addition of different types of graphene in thermoset matrixes and the compatibility adhesive-nanofiller is studied by rheological measurements and correlated to the microstructure observed by SEM. Moreover, the complete campaign designed to optimize the adhesive not only from the thermal point of view but also taking into account electrical and mechanical properties is analyzed.

2. Electronic enclosures. Highly thermally conductive Carbon Fiber composites based on graphene have been developed and tested for spacecraft electronic boxes. Heat transfer capabilities of the new thermal composite were similar to the Aluminum reference housing and 43% weight reduction with respect to the current aluminum design.

References

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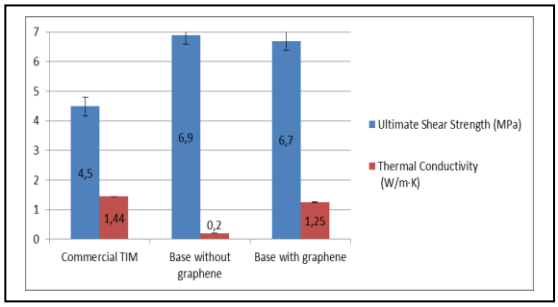
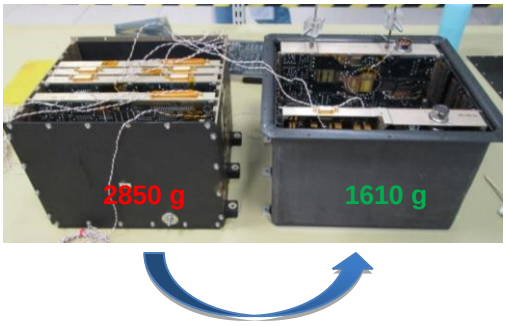
Figures





43% weight