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Editorial corner – a personal view
Thermal management with polymer composites

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An optimal thermal management is becoming increasingly important in several fields, such as building constructions, technical clothes, electronic devices and electric cars. The temperature regulation within an optimal range not only brings relevant energy savings, but also helps to avoid dangerous temperature peaks, thereby increasing the reliability and preventing premature failures. An effective contribution to thermal management can be provided by organic phase change materials (PCMs), such as paraffins or fatty acids, which store and release latent heat during melting and crystallization, at a nearly constant temperature. They feature a high energy density and a tunable working temperature, but they must be confined to avoid leakage in the molten state. This can be achieved through micro/nano-encapsulation (https://doi.org/10.3390/ma12081286) or shape stabilization with nanofillers or layered materials (https://doi.org/10.3390/polym9090405).

In applications where weight and volume savings are crucial parameters, it would be advantageous to combine the structural function and the thermal energy storage (TES) and management capability into new multifunctional polymer composites. TES functionalities have been recently embedded in structural and semi-structural composites such as epoxy/carbon laminates (https://doi.org/10.1016/j.compscitech.2018.02.005), epoxy/short-carbon-fiber composites (https://doi.org/10.1002/app.47434), polyamide/short-carbon-fiber composites (https://doi.org/10.1002/app.47408) and polyamide/glass laminates (https://doi.org/10.3144/expresspolymlett.2018.30). Additionally, a novel reactive thermoplastic (liquid methyl methacrylate) resin was added with paraffin microcapsules and investigated as a matrix for carbon fiber laminates (https://doi.org/10.1002/pc.25233), and multifunctional fully biodegradable composites were obtained (https://doi.org/10.3389/fmats.2019.00076) via the impregnation of thin beech laminae with molten poly(ethylene glycol), which were then interleaved with thin foils of thermoplastic starch (TPS) and consolidated by hot pressing. It has been proven that in the investigated composites the phase change enthalpy values can reach 50 J/cm^3, with limited effects on the elastic modulus. Nevertheless, the preferential location of the PCM in the interlaminar region is responsible for a reduction in the ultimate mechanical properties, which is still an open issue to be addressed in the future.

In conclusion, we expect that multifunctional composites combining structural and heat storage functions will open new design opportunities and increase the overall performance-to-weight ratio.

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