Editorial corner – a personal view

Recent research on conductive phase-change materials for energy storage

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Long chain paraffin-based phase change materials (PCM) for energy storage are materials that can store and release thermal energy through melting and solidification processes. Over the years a fair amount of work has been done to determine the suitability and properties of such materials. The first challenge was to find ways to prevent the leaking or flow of the molten paraffins. Some solutions e.g. encapsulation of the PCM by a thin polymeric shell and the formation of immiscible polymer/PCM blends were investigated. The most recently investigated challenge is to improve the thermal conductivity of the systems, because both polymer and paraffin have relatively high thermal resistivities.

A few papers were published during the past four years where the PCM was directly mixed with the conductive filler. These investigations included expanded graphite, carbon nanofibres and carbon nanotubes as fillers mixed into several paraffin-based PCMs. Generally the thermal conductivity increased, but several factors such as particle shape and orientation and particle dispersion were found to influence the extent of improvement in thermal conductivity. Another approach was the microencapsulation of a PCM by an inorganic conductive shell. The most investigated approach was the impregnation of thermally conductive, porous fillers with the liquid PCM. It was observed that the PCM was trapped inside the pores of the fillers, and generally no leakage was observed after melting of

the PCM. The last approach, which involves polymers, is the formation of immiscible polymer/PCM blends containing conductive fillers. The effectiveness of such systems is determined by the extent of immiscibility of the polymer and PCM, and the strength of the interaction between the polymer or PCM and the conductive filler.

To me the last approach is the most interesting from a polymer scientist's viewpoint, because there are a number of factors that may determine the properties and effectiveness of such a phase-change system, e.g. crystallization kinetics of polymer and PCM, extent of co-crystallization, location and dispersion of conductive filler particles, extent of interaction of the filler particles with respectively the polymer and the PCM, to name a few. This may not be groundbreaking research, but the results of such research will certainly contribute to the finding of solutions for the provision of renewable energy.

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