Editorial corner – a personal view

Role of polymers in developing phase change materials for energy storage

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It is now more important than ever to be able to store energy over longer periods and to effectively release the energy when needed. Research on sensible heat and latent heat phase change materials (PCMs), which started about 20 years ago, still plays an important role in addressing this problem. PCMs absorb and store heat energy when undergoing a solid-solid or solid-liquid phase change. Problems associated with the use of PCMs are their lack of long-term stability, especially under conditions of thermal cycling, the stability of the PCM-container system, and effective heat transfer, because most PCMs have very low thermal conductivity.

Apart from a multitude of inorganic materials investigated and commercially used as PCMs in energy storage, commercial waxes and fatty acids were found to be the most promising organic latent heat PCMs. Normally the latent heat of melting method for energy storage is used, but some research focused on the latent heat of solid-solid transitions. Commercial paraffin waxes are cheap with moderate thermal storage densities and a wide range of melting temperatures. They undergo negligible sub-cooling and they are chemically inert and stable with no phase segregation. On the downside they have low thermal conductivity, relative high liquid viscosities, and they are difficult to contain in a certain shape or size.

This is where polymers come into the picture. A fair amount of research has been done on the

microencapsulation of PCMs by different polymers. Work has also been done on preparing phase change materials consisting of paraffin wax dispersed in a polymer as a supporting material (shape-stabilised PCM). In this case research concentrated mostly on the use of polyolefins. The effective temperature range of such a PCM falls between the melting point of the wax and that of the polymer. It is, however, important that there must be little co-crystallization between the paraffin wax and the polymer. This system has long-term thermal stability under cycling conditions, and the PCM is well contained within the polymer matrix. There are only two persistent problems: low thermal conductivity (which may be overcome by using conductive polymers or by doping) and poor mechanical properties in the presence of high paraffin wax contents.

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