NOVEL POLYMERIC COMPOSITES FOR LATENT HEAT STORAGE

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In terms of storage capacity, application temperature range and price, paraffin waxes and polyolefins (polyethylene, prolypropylene and copolymers thereof) show great potential as phase change materials (PCM) for latent heat storages. Within this study novel tailor-made and dual latent heat storages with two defined storage temperatures were developed and characterized. Various paraffin waxes were compounded with polyolefin matrix materials and characterized regarding their storage temperature range and heat storage capacity as well as to long-term stability.

Compounds were found to be highly effective in terms of storage capacity. Moreover, various storage temperatures (between 60 and 160°C) were realized. Paraffin characteristics were not altered due to compounding. However, compounding affects the melting onset and peak temperatures of the polyolefin matrix. The pronounced temperature shift indicates immiscibility of matrix material and paraffin wax and thus distinct phase separation. Molten paraffin wax acts plasticizing for the matrix and thus decreases the melting temperature. Interestingly, compounding also changes the melting peak shape of the matrix material: on the one hand the peak is more symmetric. On the other hand, a slight shoulder (indicating a double peak) appears. Moreover, overall heat of fusion of the compound is up to 25 % higher than expected from calculation. Small Angle X-ray Scattering (SAXS) and Wide Angle X-ray Scattering (WAXS) evidenced distinct changes in matrix morphology (mean long period, crystalline order, degree of crystallinity) due to compounding. Thus, the PCM may act nucleating for the investigated matrix polymers which is advantageous for the application as latent heat storage (increase in storage capacity). Performance characteristics did not change during accelerated ageing tests (500h of static thermal load; thermal cycling with 500 cycles). The results emphasize a high innovative capacity of the novel polymeric latent heat storages.