Poster Presentation

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Developing Next Generation Phase Change Materials for Heat Storage Applications

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A large proportion of energy consumption in the UK is in the form of heat, associated with domestic and commercial heating of buildings, and the heating requirements for a wide range of industrial processes. Since many heating requirements rely ultimately on the combustion of fossil fuels, inevitably this has a major impact on the release of CO2. Furthermore, with the ever-increasing price of fuel and electricity, there are significant economic impacts for both domestic and industrial consumers. Hence there is a very strong driver towards the exploitation of renewable heat, and a key challenge for renewable heat must be effective heat storage. Latent heat storage systems have the potential to be more economical and reduce CO2 emissions compared to heating systems currently used in homes and industry. Phase-change materials (PCMs) are the key materials used in the technology, and can include organic compounds such as waxes and sugar alcohols, and inorganic compounds such as salt hydrates. On melting these materials absorb heat and on freezing they release heat. This poster describes the development of new PCMs based on hydrates of magnesium , calcium, and strontium compounds which have tailored properties such as specific melting temperature ranges, improved long-term stabilities (over many heating and cooling cycles), and high energy densities. Variable temperature crystallographic studies (single crystal and powder X-ray diffraction) provide valuable insight into phenomena such as incongruent melting, supercooling, the appearance of intermediate hydrates, and the effects of additives that promote crystal nucleation. Such information leads to a better understanding of the behaviour of these PCMs, ultimately leading to more effective methods for heat storage.

Keywords: thermal energy storage, phase-change material