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ABSTRACTS

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Phase Change Materials for Thermal Energy Storage

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I. Introduction

Phase change materials (PCMs) for thermal energy storage (TES) have become an important subject of research in recent years. Using PCMs for thermal energy storage provides a solution to increase the efficiency of the storage and use of energy in many domestic and industrial sectors. Phase change TES systems offer a number of advantages over other systems (e.g. chemical storage systems): particularly small temperature distance between the storage and retrieval cycles, small unit sizes and low weight per unit of storage capacity.

The most important application fields of PCM are energy conversation in buildings. Furthermore they can be used in other various applications like solar energy systems, thermal insulation, green houses and textiles [1, 2].

II. Discussion

The main advantage of PCMs is the capability to absorb thermal energy during heating when phase transition from ordered state to disordered state occurs. During cooling the entrapped energy is released. In order to prevent PCMs from being exposed into the external environment as well as solve the volume change in solid-liquid phase transition, PCM can be microencapsulated. In that case phase change occurs within microcapsules when heat is absorbed or released.

Different organic, inorganic and polymer materials can be used as PCMs as they have high thermal storage capability and also other important properties. In figure 1 different types of PCMs are showed [1, 2].

Due to high energy storage density, boiling point and thermal stability, one of the most promising PCMs is paraffin. It is chemically inert, long lasting, ecologically friendly, non-toxic, available and cheap. However, paraffin has low thermal conductivity and microencapsulation hinders heat transfer from paraffin to the outer of wall material of microcapsules. In order to prevent this problem, the paraffin can be mixed with metal or carbon (preferably nanographite) particles, which improves the thermal conductivity of the PCMs [3].

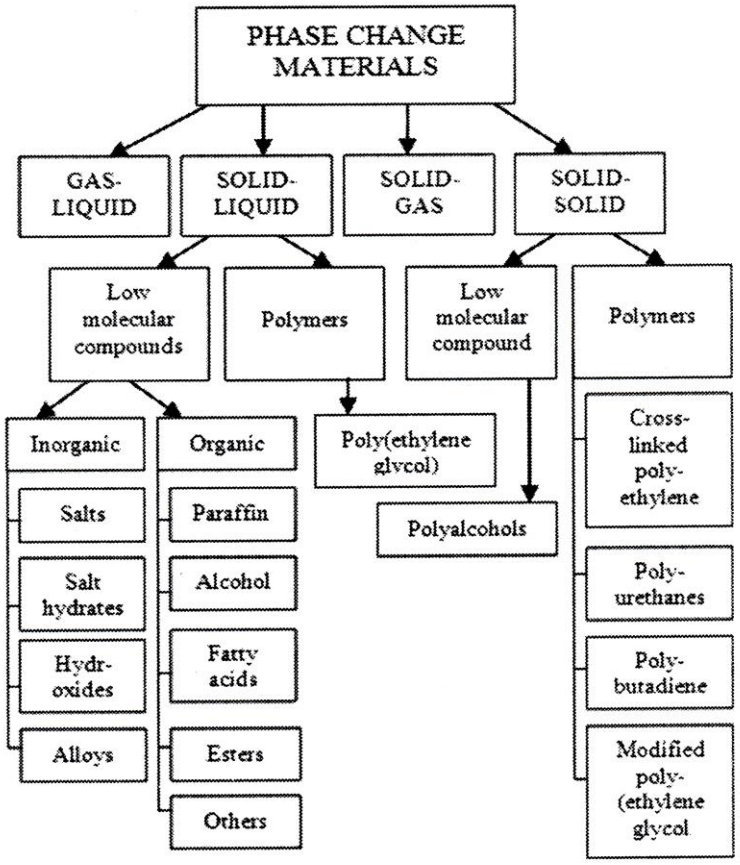

Figure 1. Classification of phase change materials.

III. Conclusions

This work described phase change material use in thermal energy storage systems. There are many phase change materials which could be used to achieve an effective thermal energy absorption and release. One of the most effective and inexpensive materials is paraffin, which modified with carbon or metal particles can show excellent properties.

References

[1] M. Mehrali, S. T. Latibari, M. Mehrali, H. S. C. Metselaar, M. Silakhori, Shape-stabilized phase change materials with high thermal conductivity based on paraffin /graphene oxide composite. Energy Conversion and Management, 2013, 67, pp. 275-282.

[2] K. Pielichowska, K. Pielichowski, Phase change materials for thermal energy storage. Progress in Materials Science, 2014, 65, pp. 67-123.

[3] M. Li, M. Chen, Z. Wu, Enhancement in thermal property and mechanical property of phase change microcapsule with modified carbon nanotube. Applied Energy, 2014, 127, pp. 166-171