PHASE CHANGE MATERIALS FOR THERMAL ENERGY STORAGE

BY

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C E R T I F I C A T E

This is to certify that the thesis entitled "PHASE CHANGE MATERIALS FOR THERMAL ENERGY STORAGE" being submitted by Mrs.Shashikala Sehgal to Indian Institute of Technology, Delhi, for the award of Doctor of Philosophy in Chemical Engineering, is a record of bonafide research work carried out by her. Mrs.Shashikala Sehgal has worked under our guidance and supervision and has fulfilled the requirements for the submission of thesis, which to our knowledge has reached the requisite standard.

The results contained in this thesis have not been submitted in part or in full to any other University or Institute for the award of any Degree or Diploma.

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A C K N O W L E D G E M E N T

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ABSTRACT

A brief review of different techniques, both applied and proposed for storing thermal energy has been presented. Considering the states of development of these techniques and their potential applications, Solid-Liquid Transition for thermal storage appears to be very attractive. However, to assist in the rational choice of Phase Change Materials extensive thermophysical properties of candidate materials is required. Literature search indicated lack of such data. After a review of the required properties, it was decided to focus attention on the two major properties, i.e., latent heats of fusion and phase diagrams for mixtures. Various experimental techniques were considered and those of Thermal Analysis and Differential Thermal Analysis were chosen. The scope of the materials studied included organic amides, acids, anhydrides, polyaromatics and halogenated benzene. Among the inorganics, Sodium Nitrate, Potassium Nitrate and their mixtures were used to test the reliability of the apparatus. Experiments with inorganic-chlorides

and their mixtures indicated experimental difficulties due to their high vapour pressure and hygroscopic nature. Hence, further work on these materials was not pursued. The reproducibility and accuracy of the experiments was gratifying. Thus, the phase-diagrams obtained could be accurately predicted by means of the experimentally determined latent heats of fusion using the Van't Hoff's equation. Theoretical considerations on freezing are also presented.

CONTENTS