AIN SHAMS UNIVERSITY
FACULTY OF GIRLS FOR ART
SCIENCE AND EDUCATION
PHYSICS DEPARTMENT

STUDY OF THERMAL PROPERTIES OF INORGANIC SALTS

Thesis Submitted in Partial Fulfillment of the

Requirements for Sc. Degree in Physics

Presented By

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Date of research: / / 1996

Post Graduate Studies:

Stamp: / / 1996 **Date of Approval: / / 1996**

Approval of Faculty Council **Approval of University Council**

/ / 1996 **/ / 1996**

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Summary

Thermal properties of molten salts are of great importance in many technological applications. Study of mechanism of heat transfer of molten salts are of almost especially importance in designing fusion reactors, breeder reactors and thermal energy storage systems.

The thermal properties data of salts are required to select an optimum condition for the desired applications.

The thermal properties: thermal activity (b), thermal diffusivity (a), thermal conductivity (λ) and volumetric heat capacity (ρC_p) of Sodium Acetate (CH_3COONa), Sodium Formate (HCOONa), and Sodium Nitrate ($NaNO_3$) salts, which are of great importance in energy technology and could be quite efficient as storage candidate salts; were measured in both solid and liquid states in the temperature range from 210°C up to 375°C.

The A.C. heated wire technique was used as a reliable and accurate technique for determining the thermal properties of such samples.

The most important feature of this method is that it can eliminate errors due to convection. Thus, this method is attractive for measurement of high temperature melts. Such as molten salts and liquid -metals, in which convection is most likely to occur.

A set up based on the A.C heated strip (wire) technique was constructed and used to measure the thermal properties of the above-mentioned salts in both solid and liquid state.

The set up was calibrated by measuring the thermal properties of double distilled water as a standard to ascertain that the obtained data for water are in good agreement with the previous published data.

Differential Scanning Calorimetry (DSC) was carried out for the above-mentioned salts.

The results obtained for the thermal conductivity of the three sodium salts (CH_3COONa, HCOONa, and $NaNO_3$) indicate that the heat transfer mechanism in these materials is due to phonon interactions. Other mechanisms such as electron or photon interaction are absent.

The results obtained for the volumetric heat capacity show that the temperature range at which measurements were carried out is above the Debe temperature for the three salts. Also, results indicated that three was no change in the structure of these salts in the considered temperature range took place.

The melting points of these substances (325°C for CH_3COONa, 325°C for CH_3COONa and 325°C for CH_3COONa) as obtained from our measurements of thermophysical properties are in a good agreement with the values obtained by DSC.

The results of thermal diffusivity and thermal conductivity show that as the molecular weight increases both properties decrease.