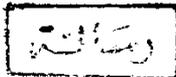


AIN SHAMS UNIVERSITY  
FACULTY OF GIRLS FOR ART,  
SCIENCE AND EDUCATION  
PHYSICS DEPARTMENT



**STUDY OF THERMAL PROPERTIES OF SOME INORGANIC  
SALTS**

Thesis Submitted in Partial Fulfillment of The  
Requirements for M. Sc. Degree in Physics

Presented By

**Ahmed Hatem Hamdy El-Dosokey (B. Sc.)**

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**TO MY PARENTS,  
MY WIFE,  
AND MY DAUGHTER RAGHAD**



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## **SUMMARY**



## 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 ( $\lambda$ ) and volumetric heat capacity ( $\rho C_p$ ) of sodium acetate ( $\text{CH}_3\text{COONa}$ ), sodium formate ( $\text{HCOONa}$ ) and sodium nitrate ( $\text{NaNO}_3$ ) 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 210 °C - 375 °C.

The AC. 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 slats 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 states.

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 previously 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 ( $\text{CH}_3\text{COONa}$ ,  $\text{HCOONa}$  and  $\text{NaNO}_3$ ) 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 Debye temperature for the three salts. Also results indicated that there 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  $\text{CH}_3\text{COONa}$ , 255°C for  $\text{HCOONa}$  and 310°C for  $\text{NaNO}_3$ ) as obtained from our measurements of thermophysical properties are in good agreement with the values obtained by the DSC.

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