

# Challenges on the determination of the thermophysical properties of molten eutectic Li, Na and K carbonate mixtures for thermal storage applications

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The need for efficient and cheap renewable energies led to the development of Concentrated Solar Plants (CSP), due to their dispatchability, by using thermal storage units based on mixtures of molten nitrate salts. However, their corrosiveness and temperature operational zones led to explore the use of molten carbonate and chloride eutectics for the future of energy storage in CSP, the first looking more reliable due to materials compatibility issues [1,2].

A project was started in Lisbon to measure thermal, chemical and thermophysical stability of a Li-Na-K-carbonate eutectic mixture. The salt was prepared from pure reagent precursors ( $\text{Li}_2\text{CO}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{K}_2\text{CO}_3$ ), and the mixing involved melting, solidification, and drying. The mixture characterization was carried out by thermogravimetry and differential thermal analysis (TG-DTA), in the range  $T_{\text{amb}}-800$  °C. The properties were enhanced by preparing dispersions of nanoparticles in the salt media, the nanosalts, namely  $\text{TiO}_2$ ,  $\text{MgO}$ , and  $\text{SiO}_2$  [3].

Existing methods for their preparation (at room temperature, obtaining a solid composite of nanoparticles in the solid salt followed by melting at higher temperatures or temperatures above the melting point of base salt eutectic mixture) will be discussed, and a new technique, which guarantees the chemical and long-term stability of the dispersions will be discussed. Thermal conductivity (transient hot-strip) [4,5], viscosity (oscillating cup technique) [6,7] melting points, and heat capacity (DSC) were the techniques chosen for the measurement. Preliminary measurements will be presented.

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