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Mixed inorganic hydrate salts as sustainable thermal energy storage technology: Synthesis and thermal behavior investigation

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Thermochemical energy storage is a qualified indirect storage. In contrast to sensible or latent heat storage, energy is stored through a physico-chemical process that consumes energy during the charging (dehydration) phase and releases it during the discharging (hydration) phase. It is not directly accessible, which has the advantage of not causing significant losses. Hydrate salts used for thermal energy storage have been always attracting topic within the research community thanks to their good performance on energy conservation applied for energy efficiency in buildings, such applications as solar domestic hot water systems. Thermochemical storage materials (TCMs) should have a high-energy storage density, multiple sources, rational price and relatively good thermal conductivity. This characteristic make of hydrate salts a worthy candidate used for heat storage. This study is focused on development of new mixed hydrated salts in order to explore new temperature range by means of salts incorporated. For the present work, structural and thermal investigations of blödite-type structure $\text{Na}_2\text{M}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ ($\text{M}=\text{Zn}, \text{Mg}$) and Kröhnkite compounds $\text{Na}_2\text{Cu}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ are reported. The preliminary results show a complete reversibility of mixed salts confirmed by XRD, FTIR and Raman spectroscopy. On other hand, the thermal analyses show different dehydration temperatures for each material. The mechanism and kinetics of dehydration/hydration reactions under water vapor sorption measurements were studied as well as the thermal efficiency to evaluate the promising salt for solar domestic hot water systems application.

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A novel ferrocene metal complexes salen-like, derived from 5-chloromethyl-2-hydroxyacetophenone and N-ferrocenemethylaniline: Design, spectral approach and solvent effect with their electropolymerizable behavior for elaboration of modified electrodes

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The research project of this work may be summarized in the synthesis, spectroscopic characterizations and electrochemical behavior of the tetradentate copper (II)-Schiff base complex with its two wings as ferrocenyl aniline moieties. This new ferrocene derivative with two ferrocenylaniline entities surrounding the copper (II)-Salen complex was synthesized from N-ferrocenemethyl-N-phenyl-5-aminomethyl-2-hydroxyacetophenone and one-half equivalent of 1,2-diaminoethane in absolute ethanol. As for the intermediates involved in this synthetic sequence, the compound was prepared in tetrahydrofuran (THF) by reacting N-ferrocenemethylaniline with 5-chloromethyl-2-hydroxyacetophenone in presence of sodium hydrogenocarbonate (NaHCO_3). The compound condensed on the diamine yields the Schiff base ligand which reacts with copper acetate monohydrate yielding the tetradentate Cu(II)-Schiff base complex. Their purities were estimated from elemental analysis while the molecular structures were elucidated with FT-IR, UV-Vis, ¹H- and ¹³C- NMR. The electrochemical behaviors of the synthesized compounds were investigated using cyclic voltammetry in diverse solvents like dichloromethane (DC), acetonitrile (AN), dimethylformamide (DMF) and dimethylsulfoxide (DMSO). The anilinic entity grafted on these compounds may be modulated by using other electropolymerizable units as pyrrole, thiophene and carbazole etc.

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