New organic-inorganic halometallates [A][FeCl4] plastic crystals for electric and thermal energy storage

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In the last decades, plastic crystals, that are molecular compounds with a phase transition to a state that possess some orientational or conformational degree of freedom, have been intensively studied for thermal energy storage applications due to their extremely large latent heat induced by the phase transition.[1]

In this context, we have recently reported that the organic-inorganic hybrid plastic crystal $[(CH_3)_3S][FeCl4]$ exhibits a first-order phase transition with a relatively large latent heat (≈ 40 kJ kg-1) and a large and sharp change a dielectric permittivity.[3] Therefore, these materials can be useful for both thermal energy storage and electrical energy storage into a capacitor and it is one of the scarce examples of multienergy storage materials.

In the search for new plastic crystals with potential capability to be multienergy storage materials, we focused on hybrid plastic crystals with general formula $[(Et)_3(XMe)N][FeCl_4]$ (X = Cl, Br). The synthesis of these compounds is very easy and they can be obtained as single phases by slow evaporation of a mixture of $(Et)_3(XMe)X$ and $FeCl_3$ at room temperature. The crystal structure of $[(Et)_3(XMe)N][FeCl_4]$ materials was elucidated by powder and single crystal X-ray diffraction. By differential scanning calorimetry (DSC), it was observed that these compounds exhibit a first order transition and the latent heat associated to the phase transition was determined. Additionally, the dielectric response of the obtained materials was studied, and they exhibit a sharp dielectric transition associated to the phase transition.

Therefore, this new family of $[(Et)_3(XMe)N][FeCl_4]$ (X = Cl, Br) compounds has interesting thermal and electrical properties that make them good candidates to be used as multienergy storage applications.

Referencias

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