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Novel multimetallic complexes as precursors for fluoride functional materials

Claudia Barbagallo, Anna L. Pellegrino, Francesca Lo Presti and Graziella Malandrino

Dipartimento di Scienze Chimiche, Università di Catania and INSTM UdR Catania, V.le A. Doria 6, 95125 Catania, Italy.

Abstract text: Multifunctional fluorides represent an emerging class of materials for several technological application, such as optics, sensors and photovoltaics. In particular, the development of ternary rare earth-based fluoride films, doped with luminescence species, has been deeply investigated for energy conversion system in solar cell devices. This technology allows the exploration of a wide range of solar energy portion, thus enhancing the efficiency of photovoltaic panels. The engineering of energy conversion layers requires an inorganic fluoride host material, based on sodium, yttrium and/or gadolinium, and a luminescence center, such as Europium. Thus, the development of stable multimetallic complexes which contain in the structure all the element forming the final inorganic layer represent a crucial aspect for their massive use. Recently, novel materials containing cesium as alkali metal have been reported. In this contest, we report the design of novel cesium-based metalorganic compounds with high volatility and good mass transport properties, that make them excellent candidate for both vapor and solution deposition approaches.

Particularly, this work reports an efficient one-pot synthesis of two novel bimetallic precursors based on cesium-yttrium or cesium-europium, using β-diketonate ligands to balance the charge of the cations, and polyethers to complete the coordination sphere. The structures of Cs(I) metal-organic compounds is "CsRE(hfa)4·2tetraglyme" [RE = Y(III) or Eu(III), Hhfa = 1,1,1,5,5,5-hexafluoro-2,4-pentanedione, tetraglyme = 2,5,8,11,14-pentaoxa-pentadecane].

The obtained precursors have been characterized through Energy Dispersive X-ray (EDX) microanalysis, infrared spectroscopy in order to assess the composition of the adducts and the structure. Thermal behaviours were investigated using thermogravimetric (TG) analysis and differential scanning calorimetry (DSC). These analyses revealed high volatility and good thermal stability with low residue in mass. Thus, these compounds represent promising precursors for the fabrication of Cs-RE films.