Europium(III) and Gadolinium(III) isonicotinates – a study on its thermal behavior

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Abstract

Thermal behavior of Gadolinium(III) and Europium(III) isonicotinates were investigated. Both compounds undergoes physical transformation, which were investigated by DSC-photovisual.

Introduction

Coordination compounds of lanthanide metals with carboxylic ligands presents interesting luminescent, magnetic and electronic properties.

Some isonicotinic coordination compounds, depending on the synthetic route adopted, presents different structures and are well known[1,2]. Some of them presenting biological activity, as in preventing intravenous thrombosis (neodymium(III) and samarium(III) isonicotinate). Another example is the terbium(III) isonicotinate, that presents a high luminescence intensity, and is a promising compound to create luminescent materials[3].

In a general way, the studies of lanthanides isonicotinates concern mainly its luminescent properties and crystalline structure. In this way, a specific study about its thermal behavior is valuable in the understanding of the chemical and physical transformations that these compounds undergoes while heated, by providing information of its crystalline transitions, thermal stability (TG-DSC and DSC) and gaseous decomposition products (TG-FTIR).

Results and Discussion

The thermal stability of the hydrated compounds (I) or anhydrous (II), and the final temperature of thermal decomposition (III), as well as the dehydration temperature range (IV) are:
(I) Eu > Gd; (II) Eu > Gd; (III) Eu = Gd; and (IV) Eu = Gd

The minimum formula were obtained by TG-DSC curves as $Ln(L)_3 \cdot 2H_2O$ (Ln = Eu and Gd).

The TG/DSC curves (Fig. 1) shows a physical phenomenon for both compounds, wich were investigated by means of DSC-photovisual system and attributed to a phase transition. The transition reversibility was confirmed by a cyclic DSC curve (heating/cooling).

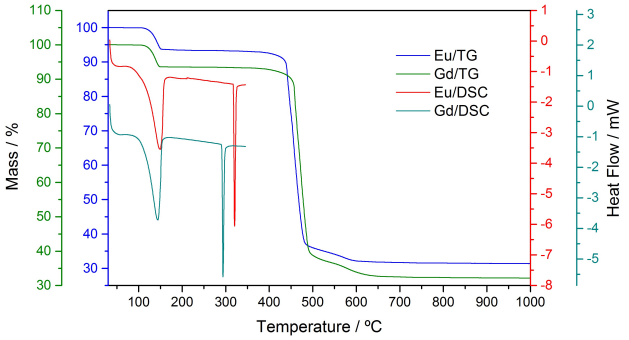

Fig. 1 - TG/DSC curves. Heating rate of 10 ºC min^{-1}, air flow of 50 mL min^{-1}.

The gaseous products released during thermal decomposition (EGA) were monitored by FTIR and are water vapor, ammonia carbon monoxide and carbon dioxide.

Conclusions

From TG, complexometry and elemental analysis data, a general formula could be established for the synthesized compounds.

The monitoring of evolved gases (EGA) shows that during the thermal decomposition the compounds occurs the release of ammonia, CO and CO_2.

From DSC-photovisual analysis it was possible to measure the enthalpies of dehydration and evaluate the reversibility of the phase transitions for gadolinium and europium compounds.

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