PROTON CONDUCTIVITY AND LUMINISCENCE PROPERTIES OF LANTHANIDE AMINOTRIPHOSPHONATES

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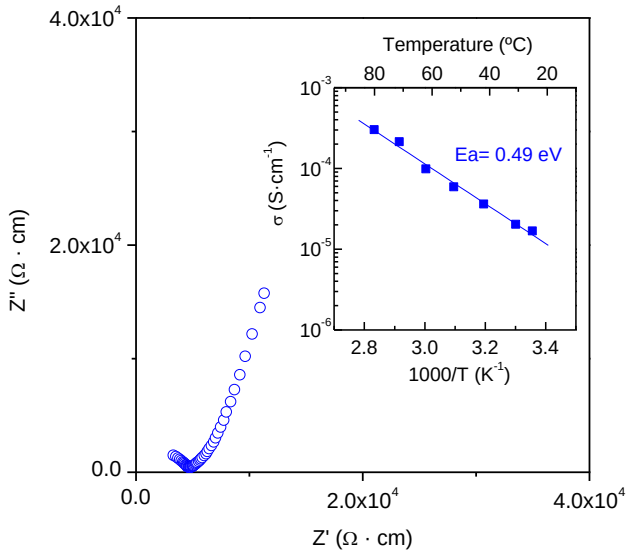
Metal phosphonates are multifunctional solids with tunable properties, such as internal H-bond networks, and high chemical and thermal stability [1].

In the present work, we describe the synthesis, structural characterization, luminescent properties and proton conduction performance of a new family of isostructural cationic compounds with general formula $[Ln(H_4NMP)(H_2O)_2]Cl{\cdot}2H_2O$ [Ln = La^{3+}, Pr^{3+}, Sm^{3+}, Gd^{3+}, Tb^{3+}, Dy^{3+}, Ho^{3+}, H_6NMP = nitrilotris(methylphosphonic acid)]. These solids are formed by positively charge layers, which consist of isolated LnO_8 polyhedra and bridge chelating NMP^{2-} ligands, held apart by chloride ions and water molecules. This arrangement result in extended interlayer hydrogen networks with possible proton transfer pathways.



The proton conductivity of Gd^{3+} sample, selected as prototype of the series, was measured. In the range between range 25º and 80 ºC, the conductivity increase with the temperature up to a maximum value of $3{\cdot}10^{-4}$ $S{\cdot}cm^{-1}$, at relative humidity of 95 %. The activation energy obtained from the Arrhenius plot (Figure 1) is in the range corresponding to a Grotthuss transfer mechanism.

Figure 1: Complex impedance plane plot for Gd^{3+} compound at 70 ºC and 95% RH. The inset shows the Arrhenius plot.

References

[1] Ramaswamy, P.; Wong, N. E.; Shimizu, G. K. H. *Chem. Soc. Rev.*, **2014**, *43*, 5913−5932.