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Eu^{+3} substituted MgAl-layered double hydroxides as photocatalysts for NO_x gases abatement emission

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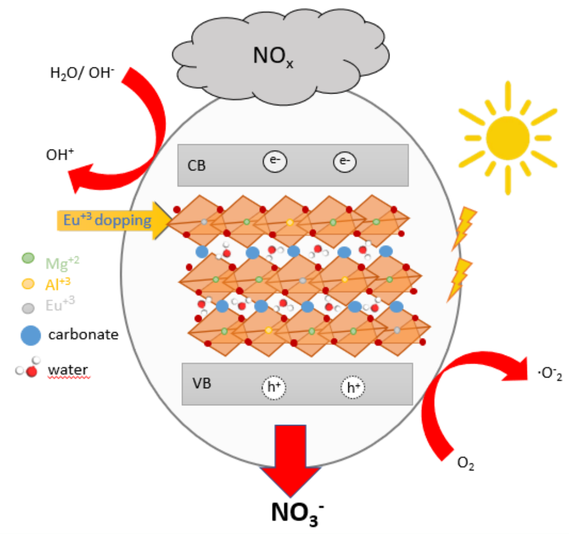
INTRODUCTION

Nitrogen oxides gases (NO_x=NO+NO_2) emissions frequently exceed the limits recommended for human health. This has turned air quality into a vital problem for modern society, leading to thousands of premature deaths per year worldwide [1].

In the last decades, **photocatalysis** has emerged as promising remediation of this problem. This technology allows for reducing emissions directly from the air using mild conditions and renewable energy.

Previous studies claim that **Layered Double Hydroxides (LDH)** are a proficient alternative as photocatalysts for nitrogen oxides removal [2, 3]. They are a class of lamellar materials with a structure similar to brucite compounds ($Mg(OH)_2$) with the general formula $[M^{II}_{1-x}M^{III}_{x}(OH)_2]^{x+}\cdot A^{n-}_{x/n}\cdot mH_2O$. Due to their particular structure and simple synthesis, the chemical composition can be easily modified with a large number of different metals, which affects the electronic properties.



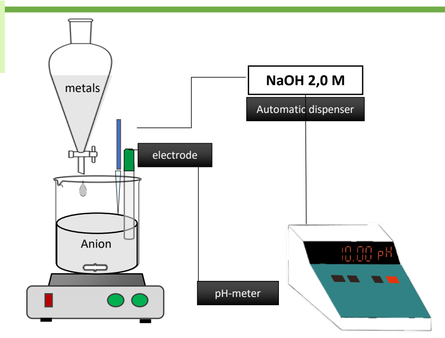
OBJECTIVE

This work aims the preparation and characterization of different Mg_3Al LDHs, on which Al^{+3} is gradually replaced by **Eu^{+3}.**These photocatalysts were studied for the NO_x gases abatement from air **(De-NO_x process).**

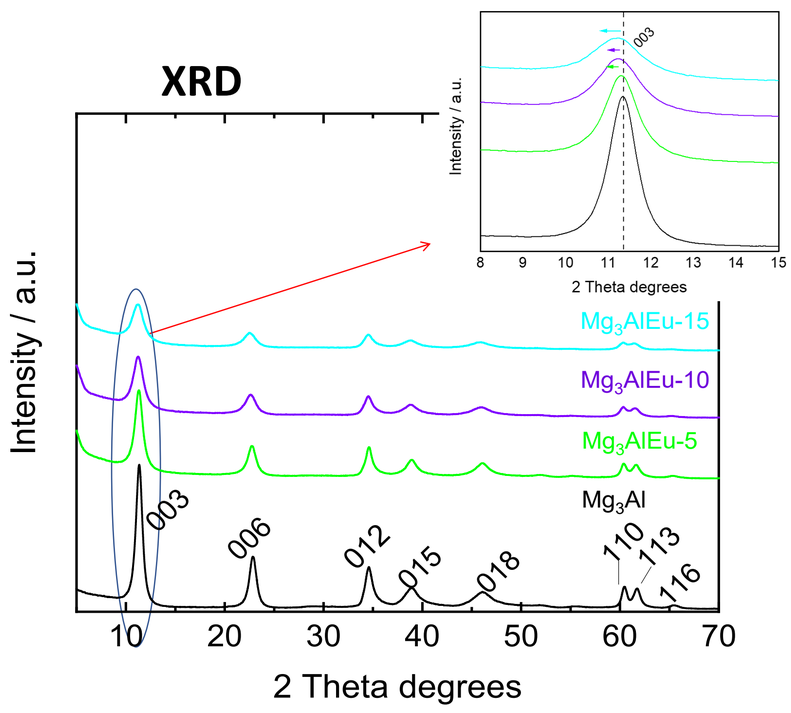
Keywords: LDH, NO_x, europium, photocatalysis.

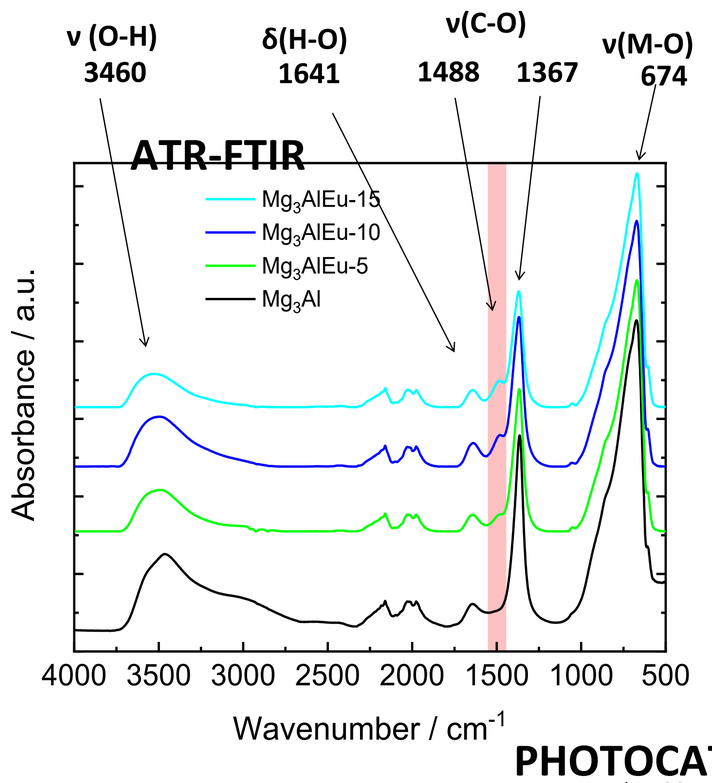
MATERIALS AND METHODS

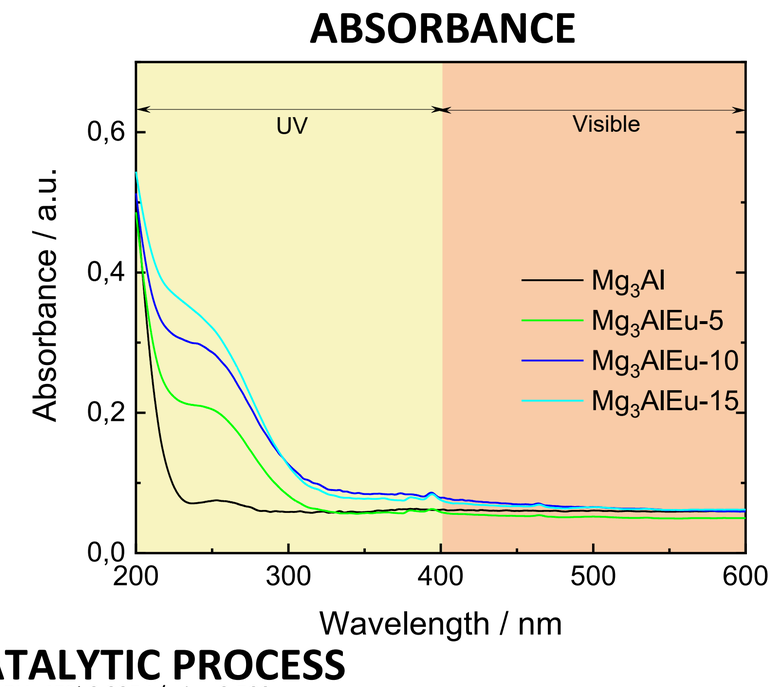
$MgAl_{1-x}Eu_x$ samples were prepared with a M^{+2}/M^{+3} metal ratio equal to 3:1 and a substitution of Al^{+3} with a 5, 10 and 15% of Eu^{+3}.

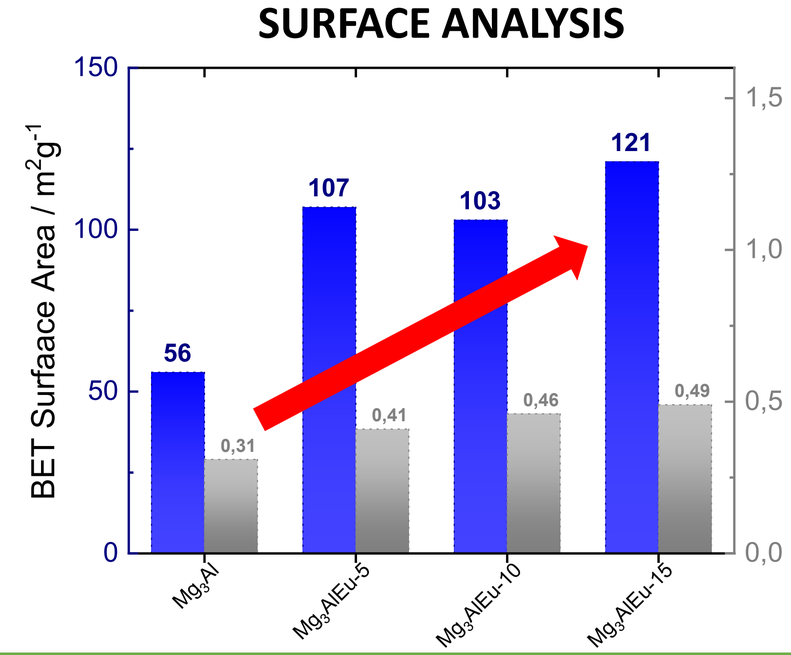


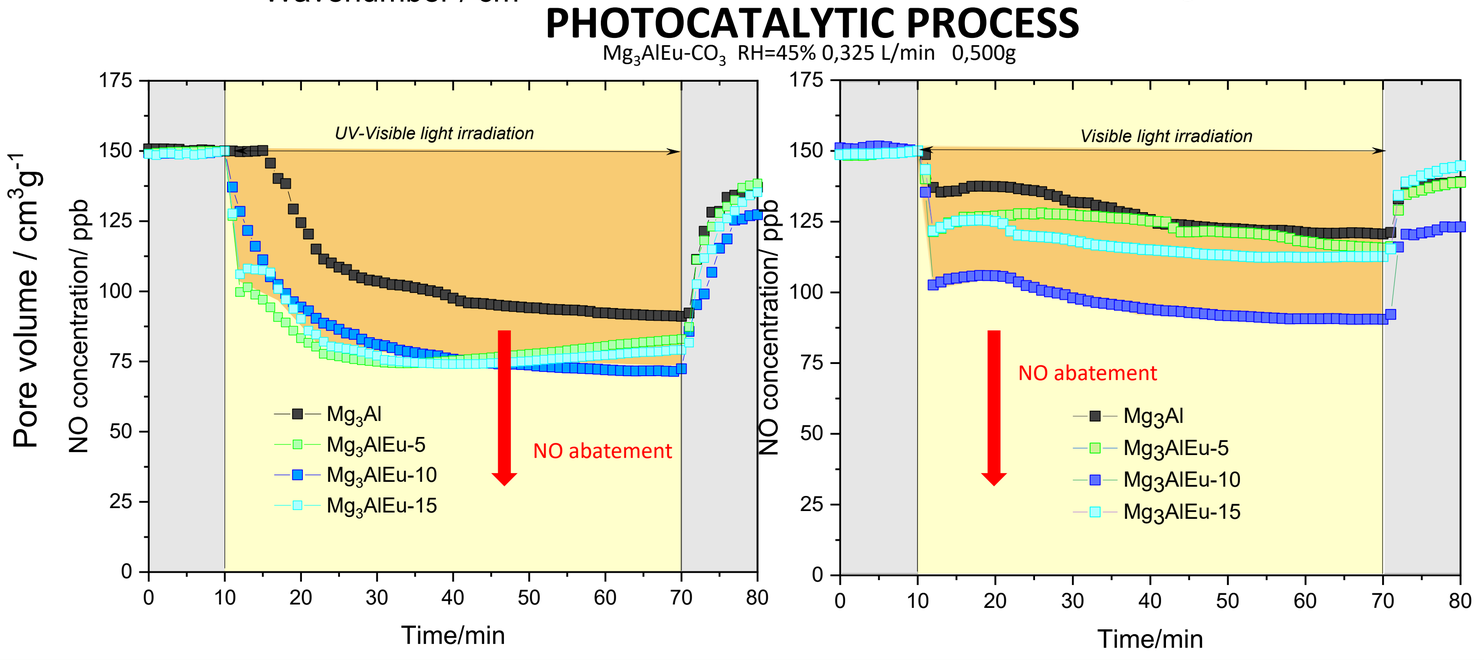
RESULTS











CONCLUSIONS

Ternary LDHs containing europium have been successfully obtained from Mg_3Al-LDH. XRD results show the incorporation of Eu^{3+} in the LDH framework, which provokes a slight shift towards lower 2θ degree values and decreases in the crystallinity of the samples. For doped samples, ATR-FTIR spectra indicate the occurrence of a small shoulder at 1488 cm^{-1} region associated with the carbonate ion, surely distorted by the incorporation of Eu^{3+}. The absorption spectrum results in an intense peak at λ=250 nm and slight absorption in the 390-420 nm visible light range increasing as the europium content do. The morphological characteristics are also affected; the increase in the surface area leads to a higher availability of active sites, which could enhance a greater photocatalytic activity. The new properties for europium doped samples boost photocatalytic activity of Mg_3Al-LDH, where the sample Mg_3AlEu-10 shows the best efficiency under both UV-visible and visible (410 nm) light, 52% and 40%, respectively.

References

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