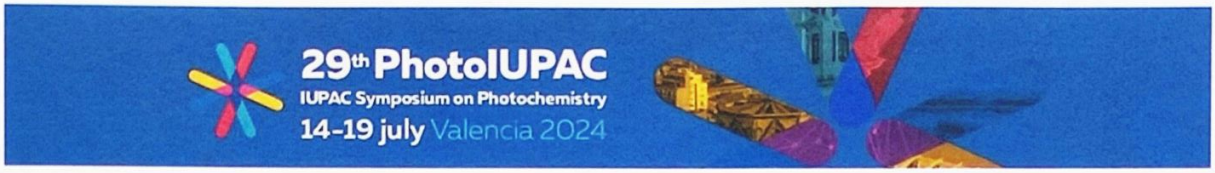

AP-01

Lattice insertion of Europium in hydrotalcite-like compound to promote De-NO_x Visible-light photocatalysis

Adrián Pastor[1]; María de los Ángeles Oliva[1]; Chunping Chen[2]; Gustavo de Miguel[3]; Dermot O'Hare[2]; Ivana Pavlovic[1]; Luis Sánchez[1]

[1]Departamento de Química Inorgánica, Instituto de Química para la Energía y Medioambiente, Universidad de Córdoba, Campus de Rabanales, Córdoba, E-14014, Spain. [2]Chemistry Research Laboratory, Department of Chemistry, University of Oxford, Oxford, OX1 3TA, UK. [3]Departamento de Química Física y Termodinámica Aplicada, Instituto de Química para la Energía y Medioambiente, Universidad de Córdoba, Campus de Rabanales, Córdoba, E-14014, Spain.

Abstract:

Over the years, the increase in road traffic and industrial activity in the urban environment has caused the emission of pollutants to the atmosphere. Nitrogen oxides gases (NO_x = NO + NO_2), are considered one of the main air pollutants due to their adverse effects on the environment and respiratory system. Although legislative measures have been taken to reduce their impact, the recommended concentration values are frequently exceeded. In the last decades, photocatalysis has emerged as a promising remediation of this problem. This process allows reducing emissions directly from the air using mild conditions and renewable energy (sunlight).[1] In this context, easy synthesis of efficient, non-toxic photocatalysts is a target to expand potential applications. Hydrotalcite is a natural mineral, it can be synthesized in laboratory, and it is commercially available. Hydrotalcite-like compounds (HTlcs), where isomorphical substitutions of the metal cations can be made, have been considered promising photocatalysts for nitrogen oxides removal.[2,3]

In this work, the role of Eu^{3+} lattice insertion in the non-toxic and easily prepared MgAl HTlcs was explored in order to prepare visible light semiconductors. Eu containing MgAl-HTlcs (MA-*x*Eu) samples were prepared using a simple method (water, room temperature, atmospheric pressure) with *x* (Eu^{3+}/M^{3+} %) ranging from 2 to 15. Due to the higher ionic radius and lower polarizability of Eu^{3+} cation, its presence in the metal hydroxide layer induces slight structural distortions, which eventually affects the growth of the particles and the specific surface area. Moreover, the presence of Eu^{3+} 4*f* energy levels in the electronic structure enables the absorption of visible light in the MA-*x*Eu samples and contributes to efficient electron-hole separation. The microstructural and electronic changes induced by the insertion of Eu enable the preparation of visible light MgAl-based HTlcs photocatalysts for air purification purposes. Specifically, the optimal HTlc photocatalyst showed improved NO_x removal efficiency, ~ 51% (Uv-Vis) and 39% (visible light irradiation, 420 nm), with excellent selectivity (> 96%) and stability (> 7 h). A variety of characterization techniques (such as EPR, *in situ* DRIFTs, TRPL, etc.) validated the role played by Eu in the photocatalytic mechanism, whereas the MA-*x*Eu HTLcs showed enhanced release of $\bullet O_2^-$ radicals and higher affinity to NO molecules. Such results demonstrate a simple way to design photocatalytic HTlcs suitable for air purification technologies.

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Acknowlegments:

This work was funded by the Agencia Estatal de Investigación (Spain; MCIN PID2020-117516GB-I00). Mª Ángeles Oliva acknowledges a contract from the Spanish Government (FPU2019/03570). Chunping Chen acknowledges support from SCG Chemicals Public Co Ltd. Adrián Pastor is grateful for a Margarita Salas contract funded by Ministerio de Universidades (Plan de Recuperación, Transformación y Resiliencia) through European Union (NextGenerationEU).