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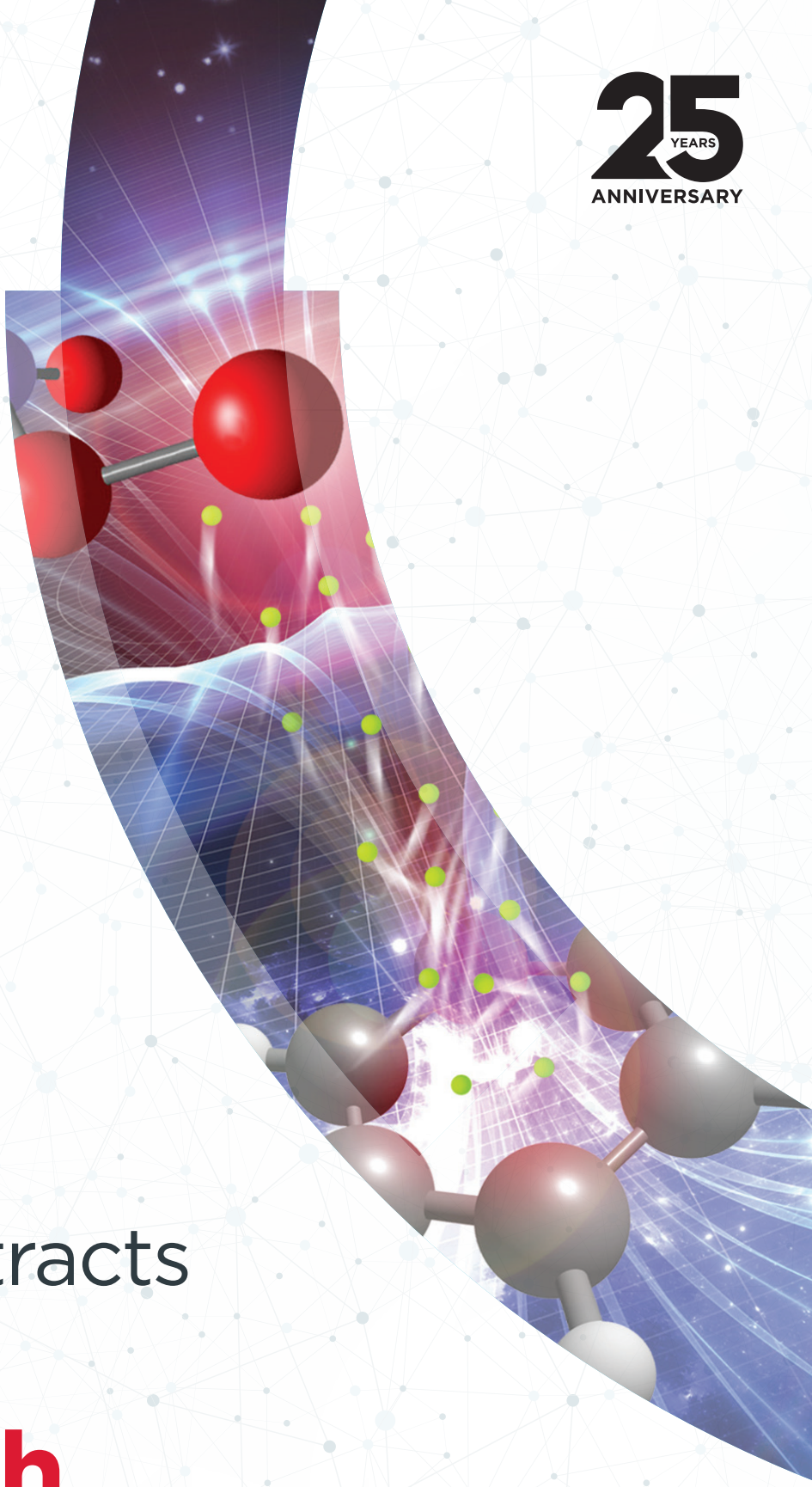

Book of Abstracts

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Halloysite based gold nanocatalysts for the catalytic conversion of biomass

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Halloysite is a natural clay mineral with a hollow tubular structure, applicable as a component of biocompatible nanosystems with specific functionalities. Its particular morphology can be exploited to obtain various organic-inorganic composites that can be used for different types of applications. For instance, Halloysite nanotubes could work as nanoreactors for various types of chemical processes.[1] In the last decades the selective oxidation of 5-hydroxymethylfurfural (HMF) to 2,5-furandicarboxylic acid (FDCA) has become one of the most important reactions that involves the use of biomass and its derivatives. As a valid alternative to the terephtalic acid, FDCA is one of the most requested chemical compounds: it should in fact be used for the production of polyethylene furanoate, a bioplastic that could replace PET. [2]

This study involves the modification of halloysite nanotubes outer surface with an organosilanic compounds, like AEAPTMS. These modifications aim to facilitate the binding of gold nanoparticles on the nanotube surface. Subsequently, the modified nanotubes are explored as heterogeneous catalysts in the oxidation of HMF to FDCA. Both computational and experimental methods are employed to investigate the reaction pathway.

The computational analysis focused on analyzing the first steps of the reaction with H_2O_2 as oxidizing agent and then going into a more in-depth analysis of the gold cluster growth.

The experimental part consisted in the optimization of a loading strategy of the gold nanoparticles on top of the halloysite surface as the starting catalyst for the biomass conversion.[3]

References

1. Lazzara, G.; Cavallaro, G.; Panchal, A.; Fakhrullin, R.; Stavitskaya, A.; Vinokurov, V.; Lvov, Y. An Assembly of Organic-Inorganic Composites Using Halloysite Clay Nanotubes. Curr. Opin. Colloid Interface Sci. **2018**, 35, 42–50. https://doi.org/10.1016/j.cocis.2018.01.002.
2. Xu, S.; Zhou, P.; Zhang, Z.; Yang, C.; Zhang, B.; Deng, K.; Bottle, S.; Zhu, H. Selective Oxidation of 5-Hydroxymethylfurfural to 2,5-Furandicarboxylic Acid Using O2 and a Photocatalyst of Co-Thioporphyrazine Bonded to g-C3N4. J. Am. Chem. Soc. **2017**, 139 (41), 14775–14782. https://doi.org/10.1021/jacs.7b08861.
3. Lisuzzo, L.; Bertini, M.; Lazzara, G.; Ferlito, C.; Ferrante, F.; Duca, D. A Computational and Experimental Investigation of the Anchoring of Organosilanes on the Halloysite Silicic Surface. Appl. Clay Sci. **2023**, 245, 107121. https://doi.org/10.1016/j.clay.2023.107121.