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Olimpia Tammaro,[1,*] Marica Chianese,[2] Maryam Hmoudah,[2] Riccardo Tesser,[2] Laura Fabris,[1] Matteo Farnesi Camellone,[3] Bruno Masenelli,[4] Vincenzo Russo,[2] Martino Di Serio,[2] Serena Esposito,[1]

[1]Departement of Applied Science and Technology, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Turin, Italy

[2] Department of Chemical Sciences, University of Naples Federico II, Complesso Universitario Monte Sant'Angelo, 80126 Naples, Italy

[3]CNR-IOM, Trieste, Italy Consiglio Nazionale delle Ricerche - National Research Council

[4] Université de Lyon, INSA-Lyon, ECL, UCBL, CPE, CNRS, INL-UMR5270, Villeurbanne, France

*e-mail: olimpia.tammaro@polito.it

The massive presence of compounds, called emerging organic pollutants (EOCs), in the environment, causes damage to the ecosystem and human health. Pharmaceutical and personal care products (PPCPs) are used in daily life, with a continuous increase in their concentration in water. The presence of ibuprofen -the third most prescribed and sold drug in the world- in both surface and wastewater has shown that the current purification methods of urban and pharmaceutical industry waste are inadequate. Among several chemical and physical methods proposed for the removal of ibuprofen, photodegradation is considered one of the most promising green chemistry technologies to address the environmental issue in water purification, due to its low-cost, versatility, and environmental friendliness [1].

This research aims to design cost-effective and high-performance catalysts that enhance the degradation of ibuprofen under visible light irradiation. Cerium oxide is a promising candidate for this purpose. This material shows a better response in the visible region of the solar spectrum and a long lifetime of charge separation, compared to the benchmark TiO_2 counterparts. Furthermore, doping with other metals can increase the ceria photoactivity. Among the heteroatom dopants, transition metals are regarded to be the most promising candidates, as they can create defect states in the band gap or introduce energy levels in it. We use a controlled precipitation approach to produce mesoporous Fe-doped Ceria nanoparticles (NPs). Ceria and doped-Ceria NPs were synthesized via a reverse microemulsion at room temperature and using BrijC10 as a surfactant [2]. Fe/CeO_2 catalysts were prepared by a one-pot reverse micelle strategy (nominal molar percentage of 0.5, 1, 2.5, 5, 10). The use of the reverse micelles approach provides an aqueous core that acts as a nanoreactor for the controlled nanoprecipitation of CeO_2 and simultaneously allows the dispersion of Fe species on the formed CeO_2 supports. The obtained samples have been calcinated at relatively low temperature and then the physico-chemical properties have been characterized by several techniques (XRD, N_2 physisorption, FESEM, UV-Vis, Raman and photocatalytic test).

The obtained results prove that the reverse micelle precipitation allowed the synthesis of highly crystalline materials, with high surface area value (SSA_{BET} up to $180 m^2 g^{-1}$) and the presence of lattice defects. The catalytic tests show different behaviour of the samples using UV or Visible light, indicating the presence of different catalytic mechanisms still under investigation. A 60% and 70% degradation of ibuprofen after 5h is achieved for the Vis and UV light, respectively (best performance is obtained with the low Fe samples).

References:

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