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ABSTRACT:

Design of nanostructured materials for photo-catalytic and photo-thermo-catalytic solar fuel production

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This lecture reports recent advances of the research carried out in our laboratory aimed at the development of suitable photocatalysts for solar fuel production, focusing on the design and the optimization of nanostructured materials for the above purpose.
Solar-driven photocatalysis represents today a promising green technology for sustainable energy production in order to achieve carbon neutrality. We have explored the potentiality of different catalysts both in the H2 production by sustainable photoreforming reactions and in the CO2 conversion into solar fuels by photo-thermo-catalytic approaches. In particular, TiO2-based composites (TiO2-rGO, CuOx-TiO2-CeO2, CoO-CuO-TiO2-CeO2) and unconventional hybrid photocatalysts (CeO2-rGO, Ni/Ce-phyllosilicates, SiC/hydrotalcites, SiC-g-C3N4 composites) have been investigated. The results showed that the performance of oxide-based systems can be strongly enhanced by means of various approaches [1, 2], such as doping with noble metals or other oxides, presence of graphenic materials, modification of their structure by introduction of defects or formation of peculiar structures, also by laser irradiation in liquid. Moreover, the synergism between photo- and thermo-catalytic processes was proved to be effective in improving the performance of some of the investigated catalysts, mainly in the case of the solar CO2 upgrading into green fuels [3].

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