Photocatalytic nanomaterials for water remediation

Roberto Comparelli
CNR-IPCF, Istituto per i Processi Chimico Fisici S.S. Bari, Bari, Italy

Photocatalytic nanomaterials are receiving a great deal of attention owing to their potential application in environmental remediation. Indeed, nanostructured materials are characterized by a high surfaceto-volume ratio leading to a high density of active sites for adsorption and catalysis and by the possibility to tune band gap and redox potential as a function of their size and shape. Wide band gap semiconductors (TiO2, ZnO) are potential candidate to photocatalysis as the redox potential of •OH/H2O pair falls in their band gap, thus photogenerated electron-hole (e-/h+) pairs can react with dissolved oxygen or water, respectively, to generate •OH. However, they can be activated only by UV light, thus limiting the fraction of solar spectrum able to generate •OH to ~4%. Current efforts in the field of designing and synthesis of photocatalysts aims at improving charge separation, inhibiting charge carrier recombination and enhancing the catalytic activity in the visible region. In this presentation a brief overview on recent advances in the synthesis of photoactive colloidal nanocrystal and their application for environmental remediation and cultural heritage protection will be reported. In particular, TiO2 nanocrystals (NCs) have been prepared with control on size, shape and surface chemistry and have been used as nucleation seeds to promote the formation of photoactive multifunctional heterostructures and nanocomposite able to exploit solar light to promote water pollutant abatement. [1, 2]

[1] A. Truppi, F. Petronella, T. Placido, M. Striccoli, A. Agostiano, M. Curri, R. Comparelli, Visible-Light-Active TiO2-Based Hybrid Nanocatalysts for Environmental Applications, Catalysts, 7 (2017) 100.
[2] F. Petronella, A. Truppi, C. Ingrosso, T. Placido, M. Striccoli, M.L. Curri, A. Agostiano, R. Comparelli, Nanocomposite materials for photocatalytic degradation of pollutants, Catal. Today, 281, Part 1 (2017) 85-100.