ICCCI 2022

The 7th International Conference on the Characterization and Control of Interfaces for High Quality Advanced Materials
and
the 57th Summer Symposium on Powder Technology

Program and Abstracts

Fujiyoshida, Japan
November 15-18, 2022

ICCCI2022

The 7th International Conference on the Characterization and Control of Interfaces for High Quality Advanced Materials and the 57th Summer Symposium on Powder Technology

1-III-E-01 INVITED
09:00-09:30, Nov. 16, Room III

Novel $TiO_2/Ag/TiO_2$ cotton-based nanocomposites for wastewater treatment

Milica Milošević [1)], Marija Radoičić [1)], Jelena Spasojević [1)], Zoran Šaponjić [2)]

1) Department of *Radiation Chemistry and Physics,* Vinča Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, Serbia
2) Institute of General and Physical Chemistry, Belgrade, Serbia

Preparation of surface modified textile fabrics with TiO_2 and Ag nanoparticles (NPs) opened-up the possibility for producing of so called high-added value textile products. Such a technological approach experiences a plentiful of barriers related to the synthesis method, deposition procedure and concentration of used NPs. Therefore, there is still a lot of room "at the bottom" to improve the efficiency and stability of such textile based nanocomposite materials. The multifunctionality and far-reaching application of the resulting nanocomposites (antimicrobial activity, UV protection etc.) is extensively recognized and their potential has been used within this research.

The novel photocatalysts grounded on $TiO_2/Ag/TiO_2$ NPs cotton-based nanocomposites were developed by fine chemical synthesis path with the goal of coping with wastewater issues and environmental remediation. A simple bottom-up approach included synthesis of colloidal TiO_2 NPs, *in situ* synthesis of Ag NPs on the surface of TiO_2 NPs previously deposited on cotton fabric, and ultimately the formation of $TiO_2/Ag/TiO_2$ sandwich nanostructure. Three types of nanocomposites were developed: CO+TiO_2, CO+TiO_2/Ag and CO+TiO_2/Ag/TiO_2. Photocatalytic performances were tested against three organic dyes: Rhodamine B (RB), Acid Orange 7 (AO7) and Methyl Red (MR) under simulated solar light.

Spherical shape of colloidal TiO_2 NPs (d ~ 4.5 nm) and TiO_2/Ag NPs (d ~8 nm) was confirmed *via* transmission electron microscopy (TEM), while the formation of uniform TiO_2/Ag and $TiO_2/Ag/TiO_2$ nano-coating was determined by field emission scanning electron microscopy (FESEM). Raman spectra of nanocomposites clearly determined the generation of TiO_2 anatase crystalline structure. Amount of TiO_2 and Ag in nanocomposites was fully defined by inductively coupled plasma (ICP) and energy dispersive X-ray (EDX) spectroscopies. Reduction of Ag^+ on TiO_2 surface was proved by appearance of SPR band of Ag NPs in UV/Vis spectra.

The highest photocatalytic performances of CO+$TiO_2/Ag/TiO_2$ nanocomposite (> 90%) indicated its exceptional photochemical ability. The same pattern of removal efficiency was retained after three reuse cycles, highlighting the importance and efficacy of mediation with stabilizing TiO_2 double-layer. The initial idea of double-loading with TiO_2 NPs was based on the possibility that immobilized Ag NPs may enhance the activity of TiO_2 photocatalyst, either from the first or the second layer, as they behave as electron scavengers and hinder the electron/hole recombination process.