The optical properties of Dopamine-TiO_2 submicronic sized particles

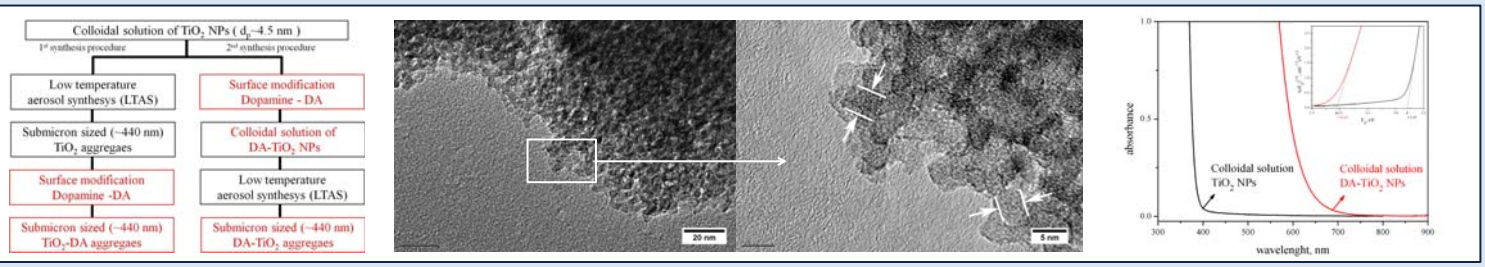
Ivan Dugandžić[1], Dragana Jovanović[2], Lidija Mančić[1], Zoran Šaponjić[2], Jovan Nedeljković[2], Olivera Milošević[1]

[1] Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000, Belgrade, Serbia
[2] Vinča Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia

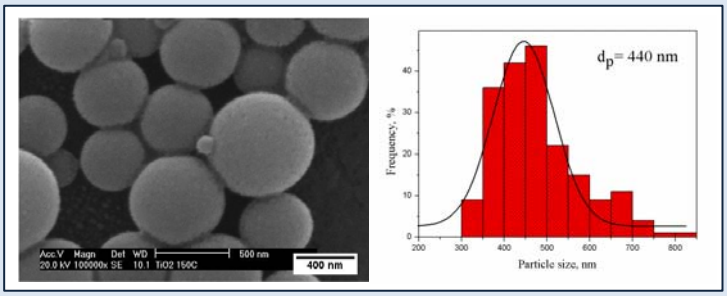
ABSTRACT

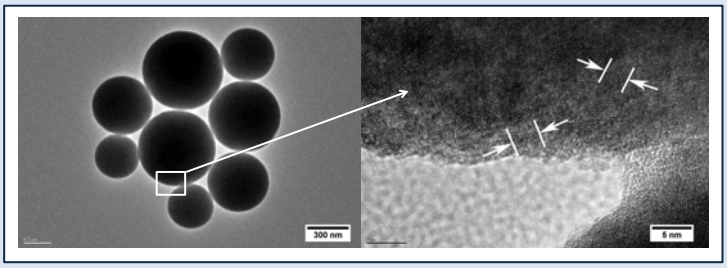
This work focuses on studying the formation of charge transfer complex, between TiO_2 surface and dopamine, that induced significant red-shift of optical absorption in comparison to unmodified TiO_2 particles. The submicron sized dopamine modified TiO_2 particles were obtained by means of low temperature aerosol synthesis using two different precursor solutions: unmodified colloid TiO_2 and the surface modified colloidal TiO_2 solution with dopamine. The obtained particles from first one were additionally modified by dopamine after completing the synthesis procedure. Transmission and Scanning Electron Microscopy show that particles obtained through both procedures have diameter of approximately 440 nm and contain small primary building units. Their surface structure and optical properties were analyzed using Fourier Transform Infrared and UV-Vis spectroscopy investigations.

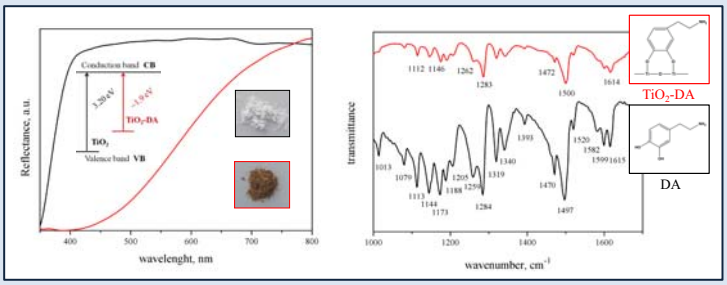
Colloidal solution of TiO_2 NPs and DA-TiO_2 NPs and their optical properties



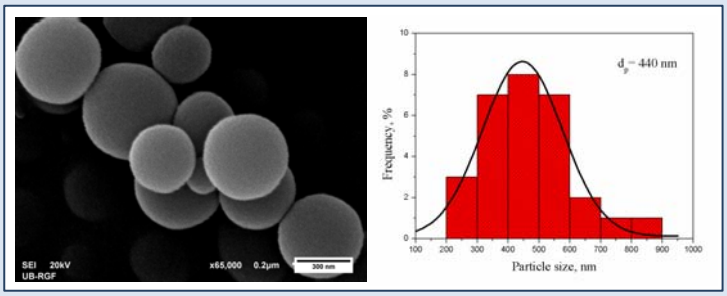
Submicron sized TiO_2-DA aggregates

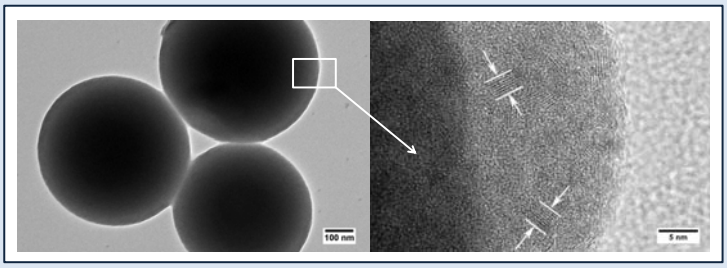


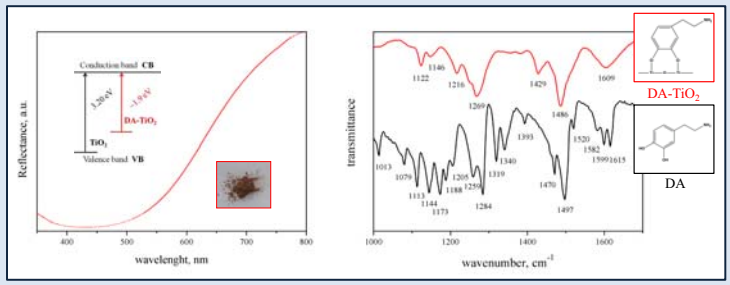




Submicron sized DA-TiO_2 aggregates







CONCLUSION

In conclusion, we proposed two different procedures for the synthesis of submicron-sized DA-TiO_2 aggregates for visible light absorption. Both of them are simple, reproducible and easy for scaling-up. Obtained aggregates have bi-functional properties: large surface area due to the nano-substructure and size comparable to the wave length of visible light, which is essential for effective light scattering. This novel nano-structured material might be a promising candidate for further optimization of working electrode morphology and DSCs overall efficiency.

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