

Synthesis and Characterization of Metal and Metal-Oxide Nanostructures for the application in Photocatalysis and Bio-Active Agent.

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ABSTRACT

Among various oxide semiconductor photocatalysts, titania has proven to be the most suitable for widespread environmental applications for its high chemical stability, nontoxicity, low cost, and excellent degradation for organic pollutants. However, the large band gap and low quantum yield of TiO_2 prevent it from practical applications. To enhance photocatalytic activity, noble metals such as Ag, Au, Pt and Pd are deposited on a TiO_2 surface, because they act as an electron trap promoting interfacial charge transfer processes in the composites. Ag NP shows antimicrobial activity and TiO_2 has potential to inhibit the denaturation of bio-active enzymes and the nanostructure metal-oxide has a great potential to improve the catalytic performance of nanozymes.

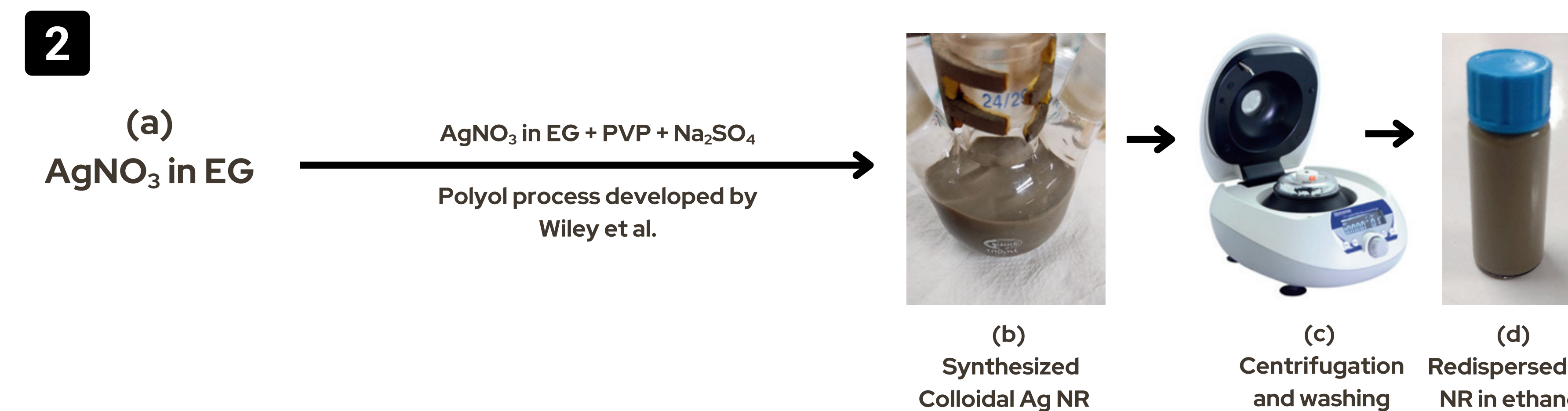
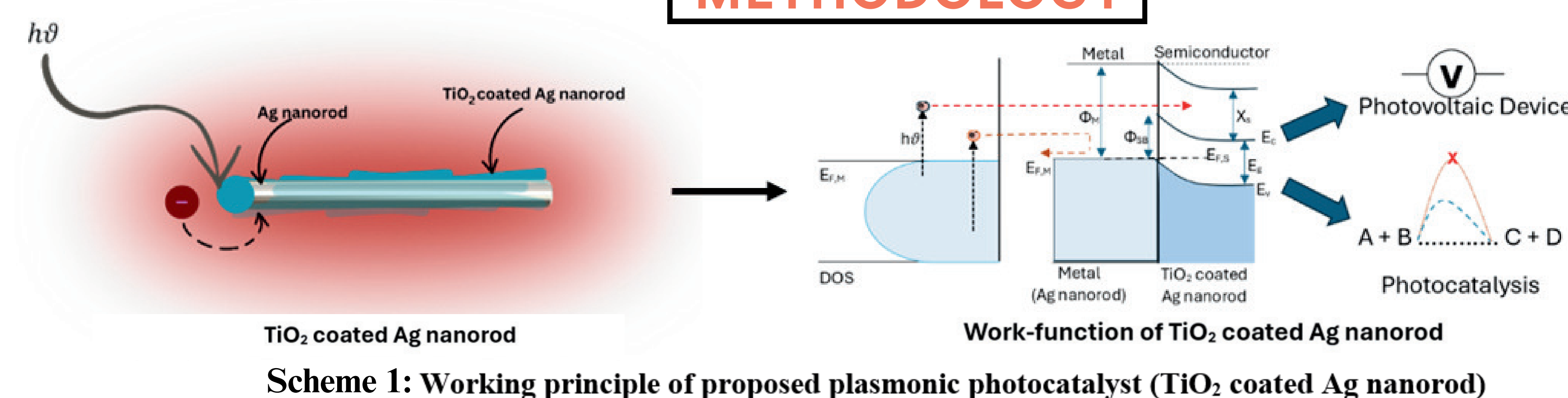
INTRODUCTION

Nanoparticles with the size range 10–1000 nm causes enhancement of catalytic activity of the attached enzymes. Ag NPs exhibits antimicrobial activity and TiO_2 has exceptional ability of absorbing and scattering ultraviolet (UV) light, which produces reactive oxygen species (ROS) that kills bacteria and viruses, along TiO_2 has potential to denature bio-active enzymes and the optimized heterostructure metal-oxide has a great potential to improve the catalytic performance of nanozymes.

OBJECTIVES

- Synthesis & characterization of Colloidal Ag Nanorods (Ag NRs).
- Synthesis & characterization of Ag@TiO_2 nanostructured core-shell and Ag NR@TiO_2 nanostructured substrate.
- Optimization of the shell thickness to enhance the plasmon-photocatalytic activity and bio-activity as bio-active agent for medications.

METHODOLOGY

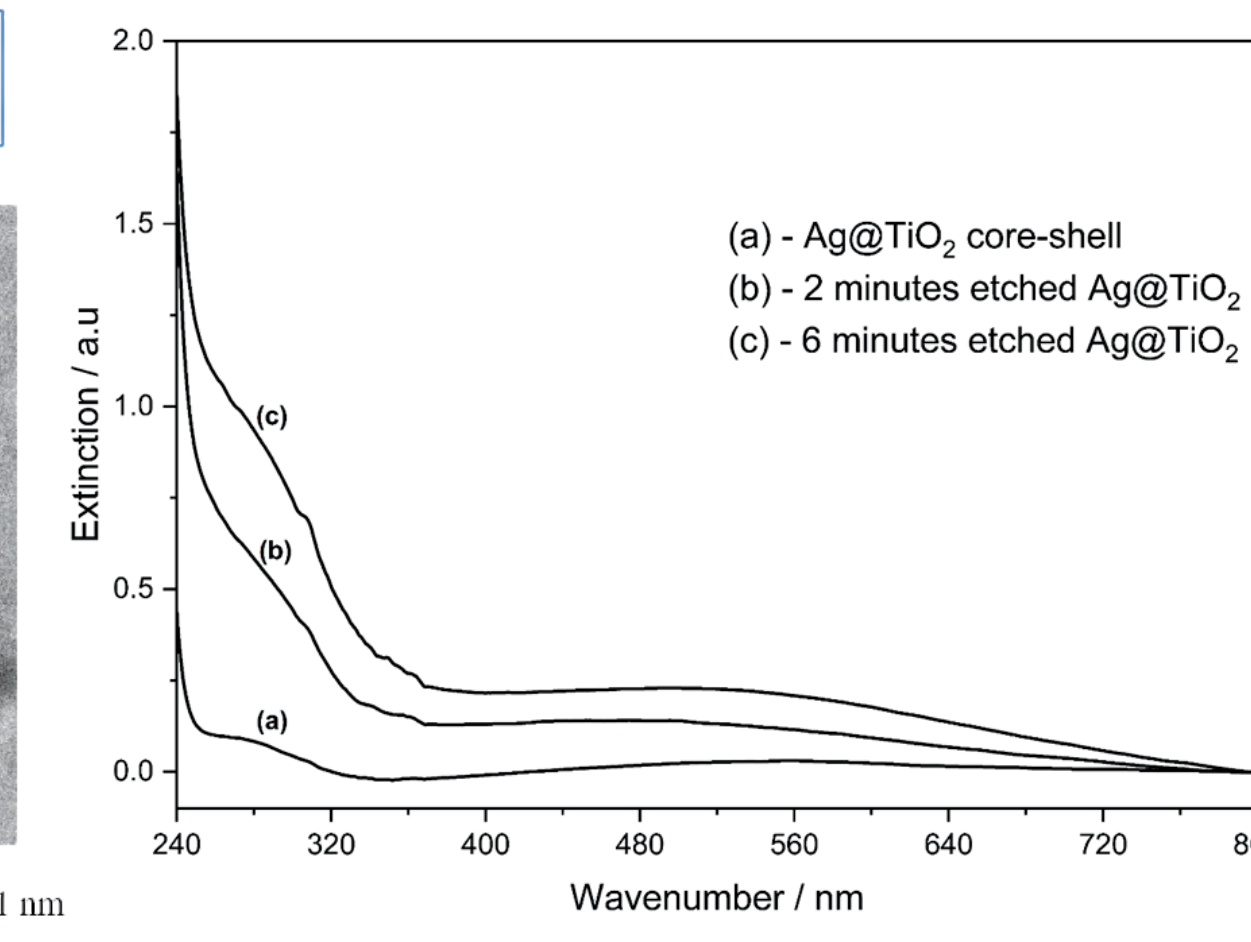
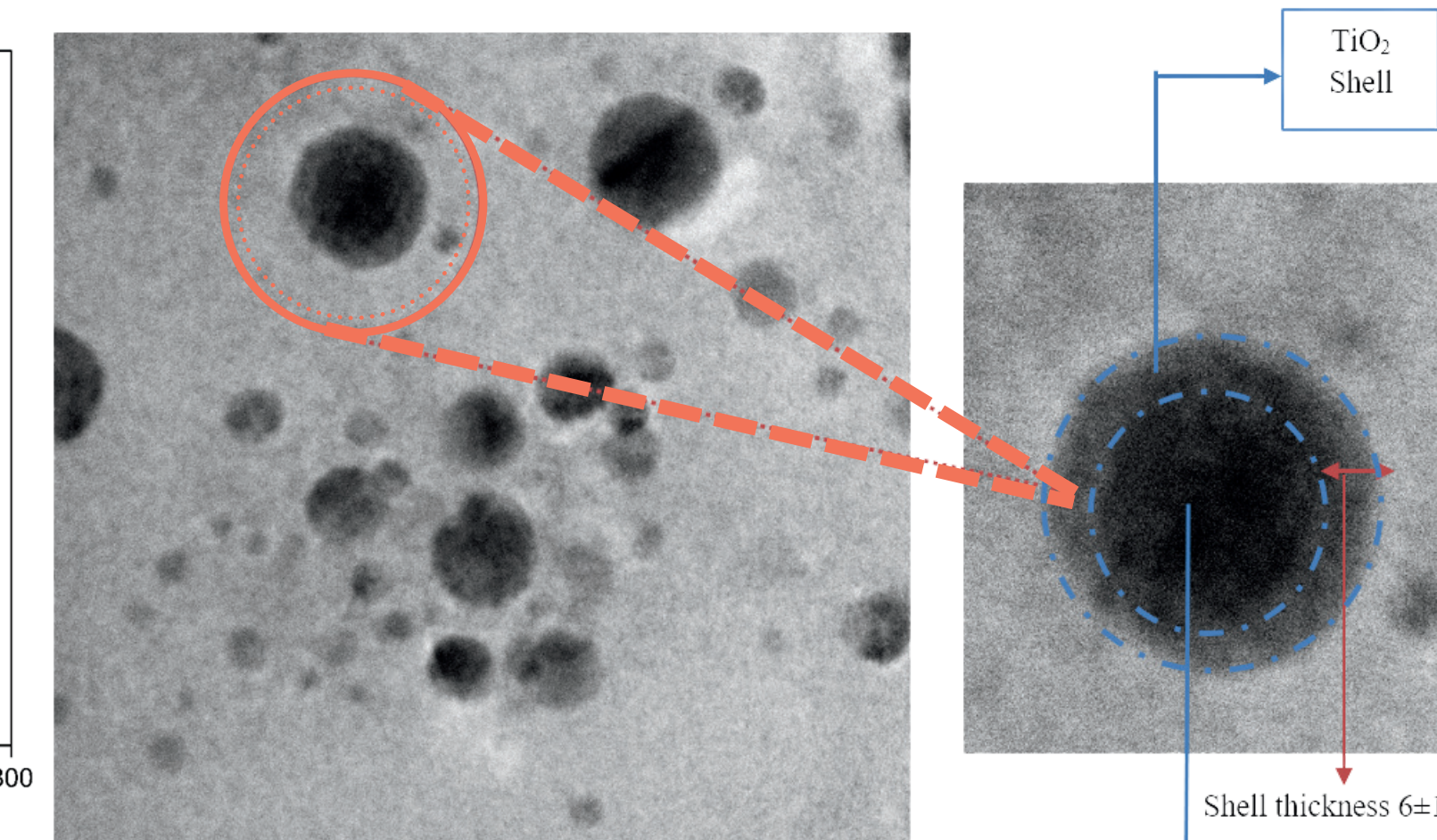
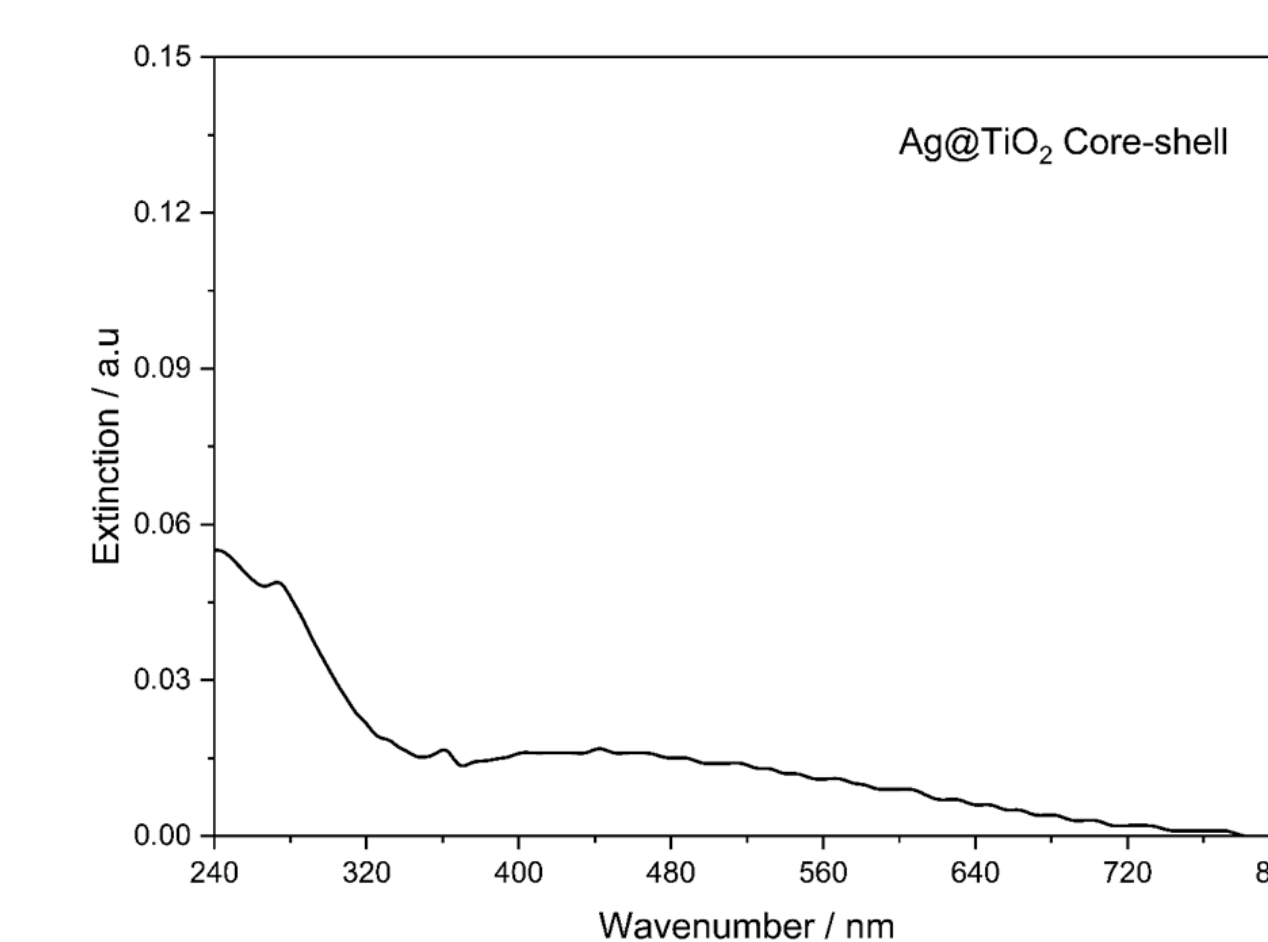


Scheme 3: Synthesis of colloidal Ag Nanorods (Ag NRs)

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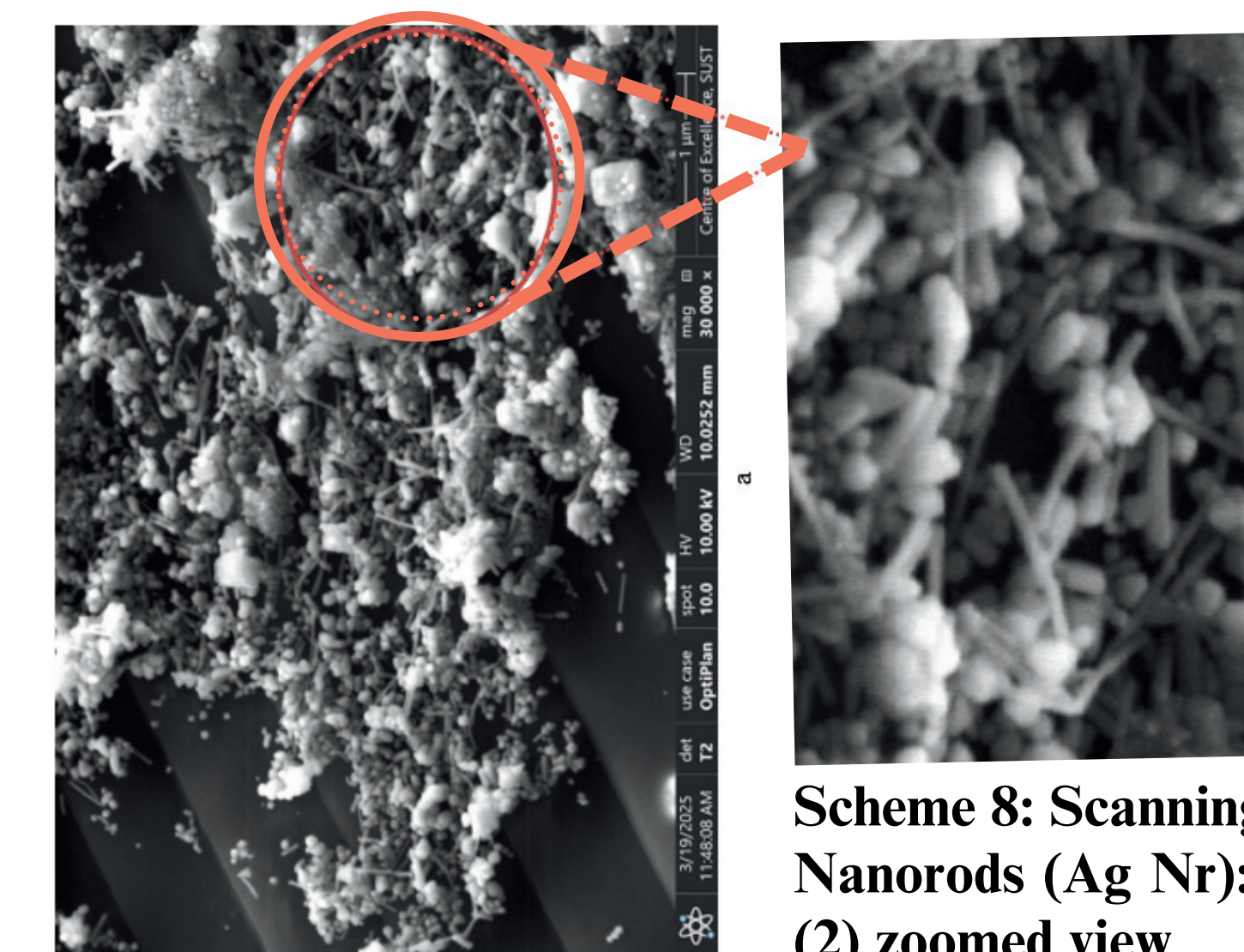
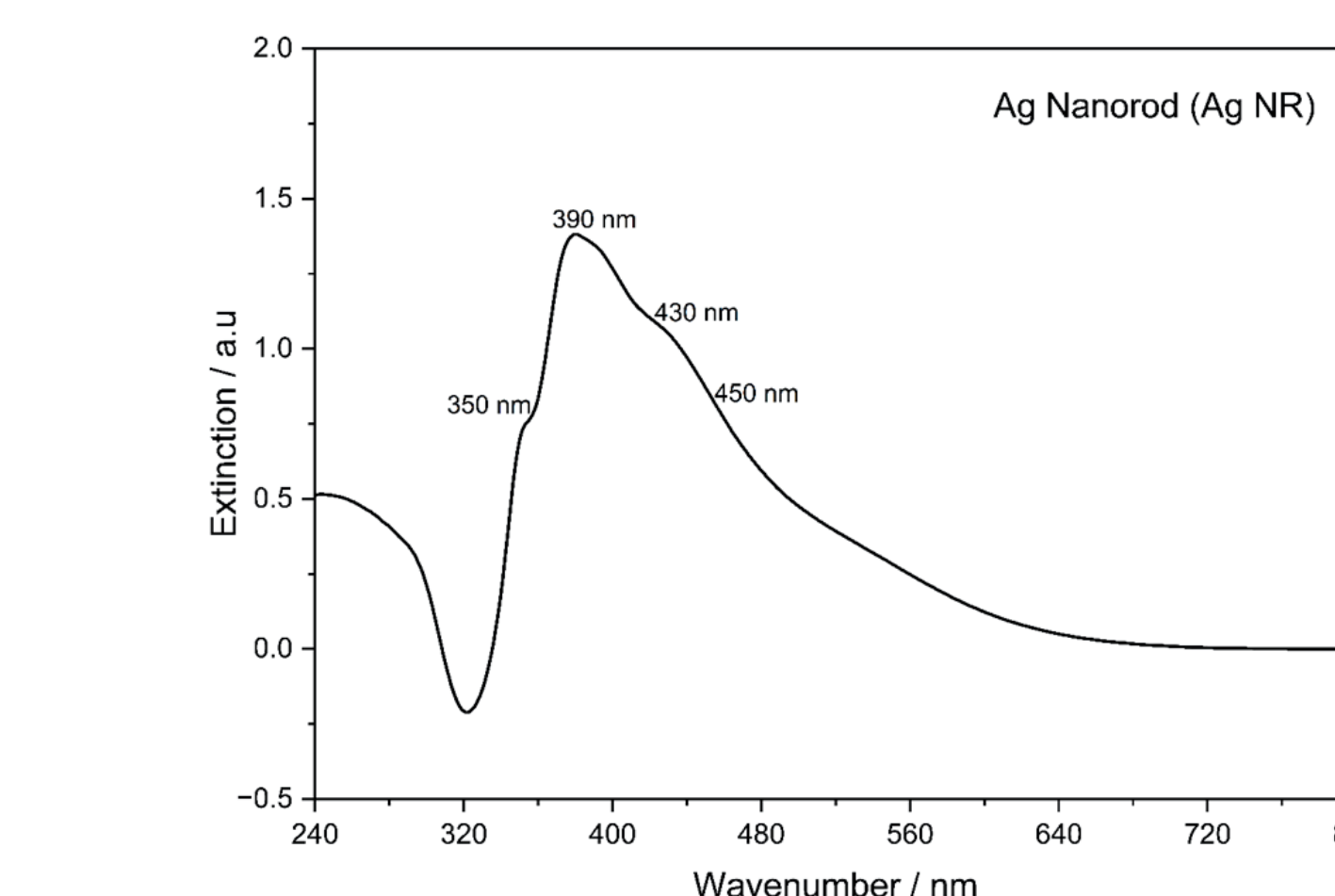
RESULT



Scheme 4: UV-Vis spectra analysis of Ag@TiO_2 core-shell

Scheme 5: Transmission electron microscopy (TEM) image of Ag@TiO_2

Scheme 6: UV-Vis extinction spectra analysis of unetched and etched Ag@TiO_2



Scheme 7: UV-Vis extinction spectra analysis of colloidal Ag NRs

Scheme 8: Scanning electron microscopy image of Ag Nanorods (Ag NR): (a) SEM image of 1-micro zoom, (2) zoomed view

DISCUSSION AND FUTURE DIRECTION

- Two different types of metal and metal-oxide nanostructured plasmonic photocatalysts were engineered where the deposition of the TiO_2 phase on the surface of the both catalysts were achieved through a solvothermal method by the structural modification of metal (Ag and Ag NR (Ag Nanorods) to metal-oxide (Ag@TiO_2 and Ag NR@TiO_2)).
- Further work will be directed towards the effective filtration and separation of Ag Nanorods from polymorphs along with the optimization of the shell thickness by controlled impregnation of TTIP to enhance the plasmon-photocatalytic activity and bio-activity as bio-active agent



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