

POLYDOPAMINE FREE-STANDING FILMS:

A POWERFUL TOOL FOR NANOCOMPOSITE PHOTOCATALYST DESIGN

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One auspicious approach in the evolving field of photocatalysis is the creation of hybrid organic/inorganic materials using biomimetic polymer polydopamine (PDA) and inorganic semiconductors (e.g. TiO₂) [1]. At the large scale, this could be achieved using free-standing PDA films from the air/water interface (a/w-PDA). The main goal of this work was to develop advanced nanoarchitectures employing a/w-PDA. First, the alternating transfer of a/w-PDA and oxide deposition using the ALD method resulted in nanometrically thin multilayers with very sharp interfaces and gradient-like N-TiO₂ doping (Fig. 1). Each of the subsequent nanostructures (1, 2 and 3 layers) was characterized by increasingly better photoelectrochemical properties [2]. In turn, an effective blanket-like deposition of a/w-PDA on the surface of H:TiO₂ nanopillars improved their photoelectrochemical properties, giving much higher efficiency towards methylene blue photodegradation. We anticipate, that the a/w-PDA films could enable many advanced nanoarchitectures for emerging applications. This project was supported by National Science Centre of Poland (NCN) by the grant 2021/41/N/ST5/00211 and 2019/35/B/ST5/00248. Authors acknowledge as well the financial support of project H2020-MSCA-RISE-2017 (project number: 778157).

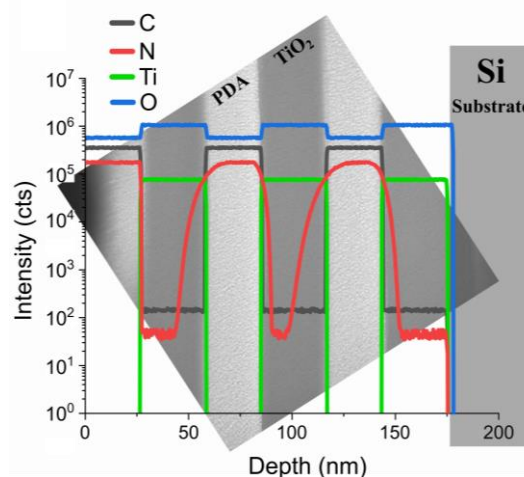


Fig.1 SIMS depth profile of the TiO₂/PDA three-layer nanocomposite together with the HRTEM image of the cross-section in the background.

References

1. D. Aguilar-Ferrer, J. Szewczyk, E. Coy, *Catal. Tod.* 2022, 397-399, 316-349
2. J. Szewczyk et al. *ACS Appl. Mater. Interfaces* 2024, 16, 8, 10774–10784