

Enhanced Photocatalytic Performance of Titanium-Phosphate Glasses under Visible-Light Irradiation

El Abiad Marouane^{1*}, Assamadi Chaima¹, El Masloumi Mohamed², Belaqqiz Majdouline³, El Abiad Abdelaziz¹, Aouad Hakima¹

¹Cadi Ayyad University, Faculty of Science Semlalia, Laboratory of Physical Chemistry of Materials and Environment, Marrakech, Morocco.

²Sultan Moulay Slimane University, Faculty of Poly Disciplinary, Laboratory of Chemical Processes and Applied Materials, Beni Mellal, Morocco.

³Cadi Ayyad University, Faculty of Science Semlalia, Laboratory of Water Sciences, Microbial Biotechnology, and Sustainable Management of Natural Resources, Marrakech, Morocco.

***Email:** m.elabiad.ced@uca.ac.ma

Abstract: This study presents an ongoing investigation into the photocatalytic properties of sodium–barium phosphate glass-ceramics containing titanium. These materials were designed within the phosphate glass system and subsequently subjected to controlled heat treatments in order to promote the formation of crystalline phases within the vitreous matrix.

The introduction of Ti-containing species is expected to enhance photocatalytic activity due to their semiconducting behavior and ability to generate reactive oxygen species under light irradiation. The glass-ceramics were synthesized using the conventional melt-quenching technique, followed by thermal treatments to induce crystallization.

Structural and physicochemical characterizations are being carried out using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and thermal analysis to identify phase evolution and structural modifications. Optical properties are also under investigation to determine band gap energy and assess light absorption capability.

Preliminary results indicate the formation of Ti-based crystalline phases embedded in the phosphate glass matrix, which may contribute to improved charge separation and photocatalytic efficiency. Photocatalytic performance is currently being evaluated through the degradation of organic pollutants under UV and/or visible light irradiation.

This ongoing study aims to establish a correlation between composition, microstructure, and photocatalytic performance, with the objective of developing efficient phosphate-based glass-ceramic photocatalysts for environmental remediation applications.

Keywords: Photocatalysis, Glass-ceramics, Phosphate glass system, Titanium-phosphate glass, Photodegradation, Optical properties.

References

1. Assamadi, C., El Binna, N., El Masloumi, M., Sayeh, K., Hasnaoui, A., Anón Casaos, A., Pascual Aranzana, F. J., Ait Ali, M., El Abiad, A. & Aouad, H. (2026). *Titanium-phosphated glass ceramics: Optimized synthesis for high-performance photocatalysis and environmental applications*. Journal of Physics and Chemistry of Solids, 209, 113315. <https://doi.org/10.1016/j.jpcs.2025.113315>
2. Radić, N., Ilić, M. & Stojadinović, S. (2025). *Photocatalytic degradation of methyl orange in wastewater using TiO₂-based coatings prepared by plasma electrolytic oxidation of titanium: A review*. Reactions, 6(2), 25. <https://doi.org/10.3390/reactions6020025>