
SBPMat
B-MRS
SOCIEDADE BRASILEIRA
DE PESQUISA EM MATERIAIS
SALVADOR
XXIII B-MRS Meeting 2025
September 28th to October 2nd
BRICS
Brasil 2025

Glass-ceramic substrates based on bismuth-vanadium phosphates for photocatalytic applications

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In view of the growing need for sustainable processes and environmental remediation, the main objective of the project is to study and synthesize glass and glass-ceramic materials containing $BiPO_4$ and $BiVO_4$ and evaluate their photocatalytic activities in the visible region for the degradation of model organic molecules and emerging contaminants [1]. To evaluate the bismuth-vanadium phosphate glass and glass ceramic as a potential photocatalytic material, the synthesis of the glass composition $Bi(PO_3)_3$-Bi_2O_3-Na_2O-V_2O_5 was performed by melt-quenching varying the V_2O_5 content, and the glass-ceramics were prepared using a heat-treatment at different temperatures above T_g. It was possible to verify the reduction of Bi^{3+} to Bi^0 by the presence of surface plasmon resonance band at 455 nm and the presence of the vanadium ions when the samples were analyzed in the UV-vis region. By DSC was possible to observe the increase of T_g in function of V_2O_5 increases, and EPR was used to determine the presence of V^{4+} in the glass matrix and the Jahn-Teller distortion of their d orbitals. The Raman spectroscopy showed a gradual depolymerization of phosphate network into pyrophosphate and vanadate-based in the glass network [2]. The XRD patter diffraction and the Raman spectroscopy showed the predominance of the $BiPO_4$ phase in glass-ceramic samples, which did not exhibit significant photocatalytic activity. Therefore, these findings demonstrate the successful synthesis of stable glasses with tunable properties resulting from vanadium addition.

Acknowledgements
FAPESP (2023/08783-6, 2022/11983-4, 2021/08111-2), CNPq (405048/2021-1)

References

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