

PhD Candidate Profile

Name:

Géssica de Oliveira Santiago Santos

Research Group (if relevant):

Grupo de eletroquímica e nanotecnologia - ITP
Grupo de Investigación en Tecnología Química y Medioambiental - ITQUIMA

Research Centre (if relevant):

Instituto de Tecnologia e Pesquisa (ITP)
Instituto de Tecnologia Química y Medioambiental (ITQUIMA)

Department/School(s) (if relevant):

N/A

College:

Universidade Tiradentes
Universidad Castilla-La Mancha

Supervisor(s):

Manuel Andrés Rodrigo Rodrigo
Giancarlo Richard Salazar Banda
Katlin Ivon Barrios Eguiluz

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Area (field) of study:

Electrochemical oxidation of organic compounds

Thesis Title:

Laser synthesis of mixed metal oxides anodes applied to the degradation of organic compounds

Abstract:

The use of agrotoxics in order to improve agricultural production has increased considerably due to the high demand for food resulting from the growth of the world population, which has led to a problem of contamination in the environment with these agrochemicals. Among these contaminants found in washing waters are organochlorine compounds that are persistent in the environment and bioaccumulative in the food chain, causing several adverse effects on human health and ecosystems. Thus, due to their high stability, presenting extreme resistance to physical, chemical and biological removal, the direct use of



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conventional treatments in order to decontaminate these effluents is not recommended. In order to overcome this problem, environmental remediation proposals have been focus of studies.

Alternative process has been developed to treat effluents containing organochlorines based on the use of advanced oxidation process (AOP), based on the generation of hydroxyl radicals, a powerful oxidizing agent that appears as a promising alternative for the treatment of organic substances with difficult degradation. Among the AOPs, electrochemical oxidation has gained considerable attention since it can be used as a pre-treatment, it occupies a significantly smaller area in comparison to other remediation processes and alone it can completely decompose organic pollutant. In this manner, electrochemical oxidation processes appear to be a clean and efficient technology for effluent treatment and present total environmental compatibility since, at the end of the process, organic compounds are reduced to CO_2 and H_2O .

On the other hand, recent studies have shown that the efficiency of electrochemical processes can be enhanced by combining two or more POAs, such as the application of ultraviolet (UV) radiation, due to the increase in the generation of oxidizing species and the better activation of these species. Thus, the present proposal is based on the study of the applicability of the photoelectrochemical process for the degradation of organochlorines, in order to optimize and analyze the degradation pathways with the use of two types of anodes (i.e., $\text{Ti/Ru}_{0.3}\text{Ti}_{0.7}\text{O}_2$ and boron doped diamond anodes), for comparative purposes. The $\text{Ti/Ru}_{0.3}\text{Ti}_{0.7}\text{O}_2$ anodes synthesized according to a low cost alternative methodology using CO_2 laser.

Collaborations:

N/A

Publications:

1. **SANTOS, G. O. S.**; SILVA, , L. R. A.; ALVES, Y.G.S; SILVA, R. S.; EGUILUZ, K. I. B.; SALAZAR-BANDA, G. R.; Enhanced stability and electrocatalytic properties of $\text{Ti/Ru}_x\text{Ir}_{1-x}\text{O}_2$ anodes produced by a new laser process. *Chemical Engineering Journal*, v. 355, p. 438-447, 2019.
2. DA SILVA, L. M., **SANTOS, G. O. S.**, PUPO, M. M. S., EGUILUZ, K. I. B., SALAZAR-BANDA, G. R.; Influence of heating rate on the physical and electrochemical properties of mixed metal oxides anodes synthesized by thermal decomposition method applying an ionic liquid. *Journal of Electroanalytical Chemistry*, v. 813, p. 127-133, 2018.
3. SANTOS, M. O.; **SANTOS, G. O. S.**; MATTEDI, S.; GRIZA, S.; EGUILUZ, K. I. B.; SALAZAR-BANDA, G. R. ; Influence of the calcination temperature and ionic liquid used during synthesis procedure on the physical and electrochemical properties of $\text{Ti}/(\text{RuO}_2)_{0.8}-(\text{Sb}_2\text{O}_4)_{0.2}$ anodes. *Journal of Electroanalytical Chemistry*, v. 829, p. 116-128, 2018.
4. **SANTOS, G. O. S.**; BERGAMASKI, F.O.F. ; MAGALHÃES, L. G., EGUILUZ, K.I.B. ; SANTOS, J.C.A.; SAMPAIO, D.V.; P.S. PIZANI, R.S. SILVA, G.R. SALAZAR-

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BANDA, Electrochemical synthesis of La-doped BaTiO₃ nanopowders, *Journal of Nanoscience and Nanotechnology*, 2019.

5. **SANTOS, G. O. S.**; SILVA, R. S.; COSTA, L. P.; CELLET, T. S. P.; RUBIRA, A. F.; EGUILUZ, K. I. B.; SALAZAR-BANDA, G. R.; Influence of synthesis conditions on the properties of electrochemically synthesized BaTiO₃ nanoparticles. *Ceramics International*, v. 40, p. 3603-3609, 2014.

Presentations:

1. **G. O. S. Santos**, R. S. Silva, K. I. B. Eguiluz, G.R. Salazar-Banda. Effect of the Calcination Temperature on the Electrochemical Properties of SnO₂-Sb Anodes Synthesized by Laser Heating (69 Annual Meeting of the International society of Electrochemistry).
2. **G. O. S. Santos**, C. W. A. Bezerra, K. I. B. Eguiluz, G.R. Salazar-Banda. Preparation and Characterization of RuO₂-IrO₂ anodes by thermal decomposition method using polyvinyl polyalcohol (PVA) (69 Annual Meeting of the International society of Electrochemistry).
3. **G. O. S. Santos**, K. I. B. Eguiluz, G.R. Salazar-Banda. *Ultra-fast method for preparation of Ti/(RuO₂)-(IrO₂)_{0,1} electrodes using laser heating.* (XXI Brazilian Symposium on Electrochemistry and Electroanalytical).
4. **G. O. S. Santos** K. I. B. Eguiluz, G.R. Salazar-Banda. *On the influence of calcination temperature on the DSAs electrochemical and superficial properties.* (XIX Brazilian Congress of Chemical Engineering).
5. **G. O. S. Santos**, R. S. Silva, K. I. B. Eguiluz, G.R. Salazar-Banda. *Electrochemical synthesis of BaTiO₃ nanoparticles with low La content.* (XIX Brazilian Congress of Chemical Engineering).
6. **G. O. S. Santos**, L. G. Magalhaes, R. S. Silva, K. I. B. Eguiluz, G. R. Salazar-Banda, F. O.F Bergamaski. *Study of the efficiency of doping with ions in nanoparticles of electrochemically synthesized BaTiO₃* (III Sergipe Electrochemical Meeting).
7. **G. O. S. Santos**, R. S. Silva, K. I. B. Eguiluz, G.R. Salazar-Banda. *Effect of electrochemical synthesis parameters on the final characteristics of BaTiO₃ nanoparticles* (XIX Brazilian Symposium on Electrochemistry and Electroanalytical).
8. **G. O. S. Santos**, L. R. Prado, R. S.Silva, K. I. B. Eguiluz, G. R. S. Banda. *The effect of solvent composition on the production of barium titanate nanoparticles synthesized electrochemically.* (Regional Congress of Chemical Engineering Students).
9. **G. O. S. Santos**, K. I. B. Eguiluz, A. S. Lima, G. R. S. Banda, F. O. F. Bergamaski. *Studies on the incorporation of lanthanum on the barium titanate lattice synthesized electrochemically.* (14th SEMPESq – Research week)
10. **G. O. S. Santos**, L. R. Prado, S. M. S. Egues, R. S.Silva, K. I. B. Eguiluz, G. R. S. Banda. *Study of the effect of supporting electrolyte concentration on electrochemical synthesis of BaTiO₃ nanoparticles.* (XI Brazilian MRS Meeting).