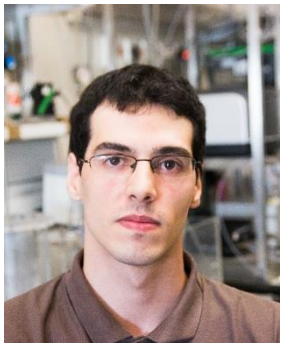
PhD Candidate Profile



Name:
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Research Group (if relevant):
N/A

Research Centre (if relevant):
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College:
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Funding body:
Fundação para a Ciência e Tecnologia (FCT)

Area (field) of study:
Removal of organic pollutants from liquid phase by catalytic wet oxidation, and from gas phase by catalytic combustion at low temperatures.

Thesis Title:
Advance oxidation processes for the conversion of organic pollutants over structured catalysts

Abstract:
The industrial growth has brought an increase in the production of wastewaters, which need to be treated before being released into the aquatic environment. Some of these wastewaters contain highly recalcitrant and bio-toxic organic compounds, which renders infeasible the traditional treatment options. Catalytic Wet oxidation (CWO) is an oxidation process that can be used to remove these organic compounds from wastewaters. This process uses high temperatures and pressures, as well as a catalyst, in order to form very reactive species, which will oxidize the organic matter. In this process, noble metal based catalysts and metal oxide catalysts are the most commonly use; however, the cost of the noble metals and the typical deactivation observed due to the formation of carbonaceous deposits and leaching of the active phase are limitations to the implementation of this technology. As such, we decided to

study the application of carbon materials (mainly, carbon nanotubes) since they are very stable at the standard reaction conditions, cheap, generally present high surface areas and their chemical and textural properties can be easily optimized, improving their catalytic activity. We will also attempt to improve the catalytic activity of this materials by several treatments (incorporation of heteroatoms, mechanical treatments and thermal treatments).

The emission of volatile organic compounds (VOCs) entails several environmental and human health problems. Increasing legislation has been limiting the concentration of these compounds in the atmosphere, forcing several industries to treat their gaseous emissions. Catalytic oxidation is one of the most efficient and economically viable technologies for VOC removal. Noble metals, such as platinum and palladium, are the most used catalysts for this application due to their high efficiencies for the oxidation of several VOCs; however, they present similar disadvantages to the ones presented in the previous case. As such, the development of active, stable and cheap catalysts is important to an efficient application of this technology. In this work, cryptomelane-type manganese oxides were prepared by a novel solvent free method using a ball mill, which reduces the time necessary to produce the catalyst, decreases the amount of waste produced and increases the catalytic activity when compared to cryptomelane catalyst prepared by the more conventional method (reflux method).

Structured catalysts (monoliths), based on the above mentioned materials, will also be prepared and optimized for both reactions. The study of this type of catalysts is important since it presents several advantages when compared to the powder catalysts, such as, low-pressure drop, high catalytic performance per mass of active phase, high specific surface area, good interphase mass transfer, safer operating conditions and a much easier separation and cleaning.

Collaborations:

N/A

Publications:

Diogo F.M. Santos, Olívia S.G.P. Soares, Adrián M.T. Silva, José L. Figueiredo, Manuel F.R. Pereira, Catalytic wet oxidation of organic compounds over N-doped carbon nanotubes in batch and continuous operation, Applied Catalysis B: Environmental 199 (2016) 361-371.

Presentations:

D.Santos, O.S.G.P. Soares, R.P. Rocha, A.M.T. Silva, M.F.R. Pereira, “Catalytic wet air oxidation of oxalic acid and phenol over carbon nanotubes”, DCE2015, Porto, 11-13 de junho de 2015, Comunicação oral.

Diogo F.M. Santos, Olívia S.G.P. Soares, José L. Figueiredo, Manuel F.R. Pereira, “Ball-milling effect in the catalytic activity of cryptomelane for VOC oxidation”, 10º Encontro Nacional de Catálise e Materiais Porosos, Lisboa, 19-20 de maio de 2016, Comunicação oral.