MARIE SKŁODOWSKA-CURIE INDIVIDUAL FELLOWSHIPS 2018

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA School of Science and Technology | CEFITEC - Centre of Physics and Technological Research

RESEARCH GROUP AND URL

CEFITEC - Centre of Physics and Technological Research
https://www.cefitec.fct.unl.pt/

SUPERVISOR (NAME AND E-MAIL)

Orlando Teodoro
odt@fct.unl.pt

SHORT CV OF THE SUPERVISOR

Orlando is graduated and has a PhD (1998) in Engineering Physics. He is the Director of the Laboratory for Vacuum Technology and Metrology (Accredited by ISO17025) and the group leader of the Surface Science and Engineering group at CEFITEC.
His main scientific interests are in field of vacuum science and technology and surface characterization techniques (mainly SIMS, XPS, AES and ISS). He also concerns with the project and development of scientific equipment.
He authors or co-author of about 100 papers published in peer-reviewed scientific journals and about 160 communications in conferences. He leads many national research projects and worked in several European projects always on the fields of surface science or vacuum technology and metrology.
His actual interests are focused on applications as scientific instruments or in vacuum technology based processes to clean or to analyze cork.

5 SELECTED PUBLICATIONS

- Felix, T.; Trigueiro, J. S.; Bundaleski, N.; Teodoro, O. M. N. D.; Sério, S.; Debacher, N. A. Functionalization of polymer surfaces by medium frequency non-thermal plasma. Appl. Surf. Sci. 2018, 428.

- Tatarova, E.; Dias, A.; Henriques, J.; Abrashev, M.; Bundaleska, N.; Kovacevic, E.; Bundaleski, N.; Cvelbar, U.; Valcheva, E.; Arnaudov, B.; do Rego, A. M. B.; Ferraria, A. M.; Berndt, J.; Felizardo, E.; Teodoro, O. M. N. D.; Strunskus, T.; Alves, L. L.; Gonçalves, B. Towards large-scale in free-standing graphene and N-graphene sheets. Sci. Rep. 2017, 7, 10175.

- Trigueiro, J.; Lima, W.; Bundaleski, N.; Teodoro, O. M. N. D. XPS spectrometer transmission function optimization by the differential evolution algorithm. J. Electron Spectros. Relat. Phenomena 2017.

- Teodoro, O. M. N. D. The Permeation of Cork Revisited. J. Agric. Food Chem. 2016, 64, 4182–4184.

- Tolstogouzov, A.; Aguas, H.; Ayouchi, R.; Belykh, S. F.; Fernandes, F.; Gololobov, G. P.; Moutinho, A. M. C.; Schwarz, R.; Suvorov, D. V.; Teodoro, O. M. N. D. Vacuum solid-state ion-conducting silver source for application in field emission electric propulsion systems. Vacuum 2016, 131.

PROJECT TITLE AND DESCRIPTION

Thermal desorption of contaminants from cork

Recently, it was shown that contaminants as 2,4,6 trichloroanisole (TCA) can be extracted from cork by thermal desorption in vacuum. This compound is the most common source of the well-known cork taint off-flavour, which has a huge negative impact on the cork sector. However, it remains unclear how molecules are so strongly bound to the cork surface. The aim of this work is to contribute to the fundamental understanding of TCA adsorption on cork in order to design proper cleaning processes.
Preliminary experiments raised several questions: (1) What impact such thermal extraction process has on the cork structure, on its chemical composition and on its mechanical properties? (2) At which temperature are relevant contaminants released? (3) Can we model the removal rate not only from the surface but also inside cork? (4) Can we realize which part of the TCA molecule binds to cork? (5) On which cork's component(s) TCA is bound — to lignin, to cellulose or to any other? Some of these questions are of practical interest to confirm if thermal vacuum extraction processes preserve the required properties of cork for wine sealing. Others have a fundamental relevance in order to properly understand how contaminants are attached to cork.
This plan should address some or all of these questions. Temperature programmed desorption coupled to mass spectrometry will be extensively used to study desorption of typical cork contaminants. Similar contaminant molecules, such as trichlorobenzene or dichlorobenzene, will be used to understand the adsorption bonds. Manipulated substrates, enriched or depleted in one of cork major components will be used to investigate to which component TCA, or other contaminant, is preferentially attached. Chemical and structural characterization as well as physical tests will show how cork is affected by vacuum heating. Gas flow simulations will provide a way to model the penetration of the extraction process.

SCIENTIFIC REQUIREMENTS
The PhD holder should have a good background on analytical chemistry preferentially including mass spectrometry. Experience on vacuum technology is welcome but not mandatory.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST

Chemistry (CHE)