MatFyz CONNECTIONS 2025

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Book of Abstracts

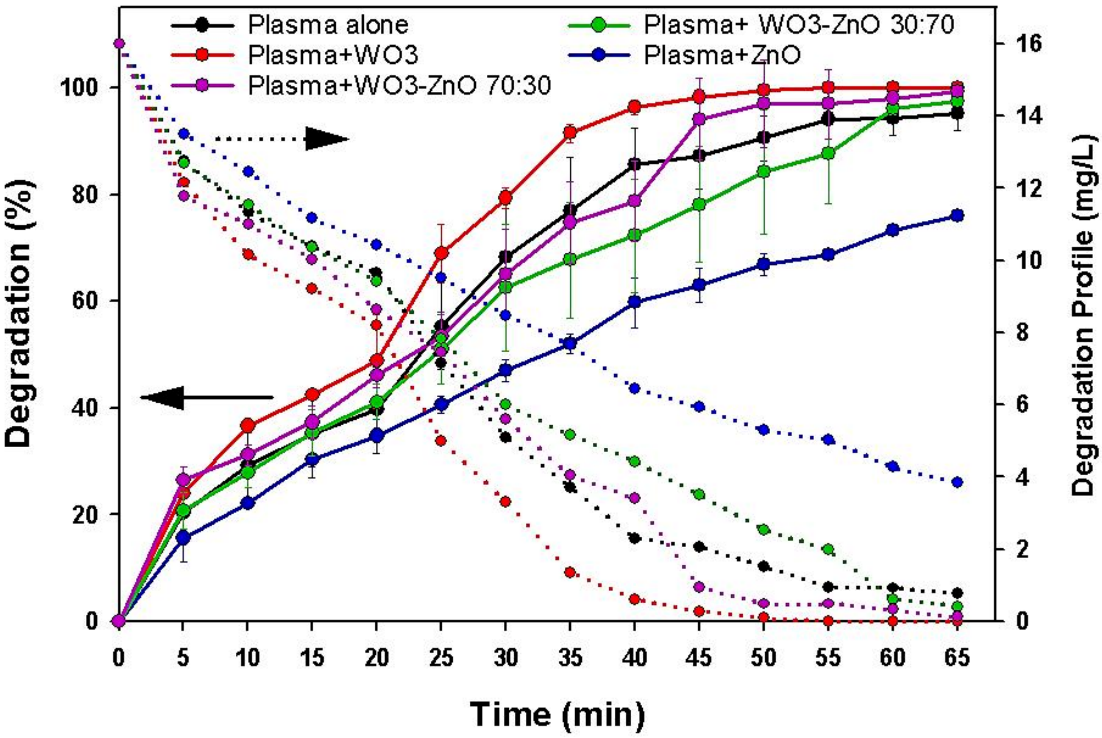

Figure 3:

Keywords:

Dielectric Barrier Discharge; Plasma–Photocatalysis; WO_3–ZnO Composite; Coumarin Degradation; Advanced Oxidation Process

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ID:106# Large scale air decontamination system using dielectric barrier discharge combined with UV activated TiO_2

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Indoor air can be polluted by many different harmful contaminants, such as chemicals, viruses or bacteria, aerosols or fine particles from combustion, among others 1. The recent global pandemic is the perfect example showing how contaminants such as viruses are dealt with. Instead of destroying or inactivating them, physical barriers, i.e. filters, were mostly used. Similarly, current decontamination systems mostly rely on filters (HEPA, mechanical, electrostatic), whatever the pollutant. Such non-destructive methods work but they induce lots of maintenance costs for changing filters, which “store”the pollutants and produce potentially harmful wastes if not handled carefully.
For these reasons, alternative destructive methods have been developed. Among advanced oxidation processes, the combination of cold atmospheric pressure plasma with UV activated photocatalysts is very promising [2]. The plasma generated electrons, ions, reactive oxygen and nitrogen species,

combined with the photocatalyst-generated radicals (OH, O2•−) allow for the oxidation or decomposition of most chemical pollutants, as well as the inactivation of bio contaminants [3].
This work focuses on a large-scale air decontamination system, which combines a volume dielectric barrier discharge (DBD), with a UV-activated TiO2-coated textile as photocatalyst. The latter is activated using UV-C lamps. An important feature of the setup is that it can treat large volumes of air (several hundred L.min-1) in a single pass, making it closer to real applications than typical lab reactors. The efficiency of the system against VOC (formaldehyde) is assessed using FTIR measurements of the outlet gas. The production of ozone is also monitored using UV absorption spectroscopy. To better understand the process, the importance of the different elements (DBD, UV, photocatalyst) are also studied separately. Additionally, the influence of the specific input energy and the distance to the discharge are investigated, giving a better view of the synergetic effects between the discharge and the photocatalytic effect, as well as the fragmentation pathways of the VOC. Finally, preliminary results on the deactivation of E. Coli and S. Aureus by the systems are presented [4].

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Keywords: Indoor air decontamination; Plasma photocatalysis; FTIR.

References:
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[4] T. Vazquez, A. Lavrikova, et al., J. Electrostat. 138 (2025) 104160

ID:26# Nonlocal Four-Terminal Method for Electrical Measurements

Author: Mykhaylo Bilogolovskyy

The four-terminal measurement technique is a foundational and widely utilized method for determining the electrical conducting characteristics of materials, especially thin films, bulk crystals, semiconductors, and complex nanostructures. By employing four separate electrical contacts - two for current injection and two for voltage measurements - on top of a sample, this methodology effectively eliminates the influence of contact and lead resistance, which can otherwise introduce significant errors in resistance and conductivity measurements. Here, we introduce a through-sample nonlocal four-terminal method based on the Landauer-Büttiker approach relating the electrical resistance to scattering properties of a mesoscopic conductor. The new methodology has been tested on all-metallic hybrid sandwiches composed of two 80 nm thick NbN films and a 50 nm thick core made of three archetypal ferromagnetic materials, F = Co, Ni, or NiCu alloy. Using a simple equivalent circuit model with six resistances connecting the four probes, we have explained some unexpected findings in the normal state and the temperature range corresponding to the normal-to-superconducting transition. Notably, it relates apparent negative resistances of some trilayers above the NbN critical temperature. By comparing NbN and NbN/F/NbN trilayers, we demonstrate that the inclusion of an F interlayer leads to a significant shift in the onset of the superconducting transition, particularly in the near-surface region, and increases the overall transition width. This work provides insights into the delicate interplay between superconductivity and magnetism and opens pathways for engineering interface-sensitive superconducting spintronic devices.

ID:70# OSCAR Benchmark: Single-station Site Characterisation

Authors: Miriam Kristekova; Jozef Kristek; Peter Moczo

OSCAR (One-Station methods for site ChARacterisation) is an international, collaborative benchmark that compares single-station approaches—i.e., methods using a single three-component seismometer—for estimating subsurface structure. Its goal is to provide the missing standardized framework for comparing these increasingly popular methods, which offer low cost and simple logistics at the expense of accuracy and/or reliability of results compared to multi-station methods. Inversions for structure from single station methods lack systematic inter-team validation, transparent