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ΟΜΙΛΗΤΗΣ: **Dr. Christos Aggelopoulos**, Research Associate
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ΘΕΜΑ: **Remediation of NAPL-contaminated soils by dielectric barrier discharge plasma**

ΤΟΠΟΣ: Αίθουσα Σεμιναρίων ITE/IEXMH

ΗΜΕΡΟΜΗΝΙΑ: **Δευτέρα, 13 Οκτωβρίου 2014**

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ΠΕΡΙΛΗΨΗ:

Soil contamination by non-aqueous phase liquids (NAPLs) could, seriously, affect human health through direct contact with soil, food chain, and contaminants in water resources. Soil pollution is often caused by industrial activity and urbanization, improper disposal of chemical and industrial waste, leakages from underground storage tank rupturing, downward migration of leachates from landfills, oil spills from accidents and fuel dumping. The most common NAPLs involved in subsurface contamination include poly-aromatic hydrocarbons (PAHs), pesticides, chlorinated solvents (e.g. PCBs) and petroleum cuts (gasoline, diesel oil, kerosene) containing alkanes of high molecular mass.

Non-thermal dielectric barrier discharge (DBD) plasma was examined as an advanced oxidation process (AOP) for the remediation of soils. Two DBD reactors (cylinder-to-plane and plane-to-grid) operating with air at atmospheric pressure were used to remove a model NAPL (i.e. a mixture of n-C_{10}, n-C_{12} and n-C_{16}) from soil layers. The concentration and composition of the residual NAPL in soil were determined with NAPL extraction in dichloromethane (DCM) and GC-FID analysis. The effect of treatment time, soil heterogeneity, NAPL concentration, energy consumption, and soil thickness on the NAPL removal efficiency was investigated, the plasma active species were identified, and the macroscopic gas temperature was determined.

The experimental results indicated that the rate of overall NAPL removal efficiency decreases with its concentration increasing and as soil heterogeneity is enhanced. The NAPL remediation efficiency can be as high as 99.9% after 60-120 s of plasma treatment, depending on soil thickness. The energy density required to remediate completely the NAPL was about 600 J/g-soil and was practically independent of the soil thickness, indicating that the DBD plasma has the potential to become a highly cost-effective technology for the remediation of NAPL-contaminated soils. Ozone is believed to be the main factor in NAPL remediation, while gas temperature can rise at about 280 ^{o}C. Using ATR-FTIR in combination with high-throughput organic profiling analysis by GC-MS, ketones and alcohols were identified as the main degradation intermediate products of the NAPL (mixture of alkanes).

Short Bio

Dr. Christos Aggelopoulos is a Research Associate at FORTH/ICE-HT. He is a physicist by training with an MSc in Physics (Environmental Sciences) from the University of Patras (2004), and his PhD on transport properties in soils from the same University (2007). He has been Post-Doctoral Fellow and Research Associate at FORTH/ICE-HT (2008, 2010-2012), Institut Francais du Petrole-IFP, France (2009-2010), Université Pierre et Marie Curie – Ecole Nationale Supérieure de Chimie de Paris, France (2012-2014). His research activities are focused on (i) multiphase flow and transport phenomena in porous media with application to liquid pollutants spreading in subsurface, (ii) remediation of polluted soil/groundwater by advanced oxidation processes (AOPs), (iii) carbon dioxide storage in depleted oil/gas reservoirs and deep saline aquifers and (iv) analysis of the pore structure of materials. He has participated in 10 R&D projects funded by the EU and the General Secretariat for Research and Technology. He is, currently the Principal Investigator (PI) of the research project SOIL-PLASMA (Supporting Postdoctoral Researchers-NSRF, 2012-2015), which was among the eight cited as most-promising projects in the 2013 NSRF report. In 2013, he was as elected as Principal Researcher (Research Engineer in Petrophysics, Cadre Position IIbis) in the Geosciences Division of Institut Français du Pétrole Energies Nouvelles-IFPEN (declined the offer accepting the Research Associate position at FORTH/ICE-HT). He has published 20 articles in refereed scientific journals (h index: 8) and more than 35 papers in international and national conference proceedings.