TOMÁŠ HOMOLA

Faculty of Chemical and Food Technology STU

Project number
2189/02/02

Project duration
9/2022 - 8/2025

BIOGRAPHY

I studied Plasma Physics at Comenius University in Bratislava and spent half of my doctorate as an Intern at the Singapore Institute of Manufacturing Technologies in Singapore. After PhD. I started as a post-doc at Masaryk University in the Czech Republic, where I became a scientist involved in R&D of atmospheric plasma technologies for additive manufacturing, flexible electronics and bioapplications. I have experience from various long-term research stays, most notably with partners in Finland. We collaborate on the applications of inkjet-printed photocatalysts for the treatment of marine water and water for human consumption. This successful and ongoing collaboration will continue with the scope of the SASPRO2 project devoted to the development of new photocatalysts for wastewater treatment. I believe that SASPRO2 project will allow me to broaden my horizons beyond plasma physics/chemistry and material engineering toward environmental engineering. This will help me to develop a competitive and mature scientific profile and strengthen my capacity to set up and lead a competitive team and participate in the success of STU and excellent science in Slovakia.

PROJECT SUMMARY

Craphitic carbon nitride - advance nanometrial in wastewater treatment

The most important part of water management involves water disinfection in order to avoid proliferation of potential pathogens and related diseases. Currently, the drinking and wastewater purification plants provides nearly perfect treatments, however, trace amounts of pharmaceuticals and resulting antibiotic-resistant genes and bacteria (ARGB), still remain. Although low concentrated, these amounts have a considerable impact on public mental and physical health. The advanced oxidations processes (AOPs) for water disinfection such as heterogeneous solar photocatalysis attracted extensive attention of researchers in recent years because it can inactivate pathogenic microorganisms and decompose organic pollutants in the water. 2D nanomaterials including novel metal-free, non-toxic, graphitic carbon nitride (g-C3N4) have several attractive features designate it for applications in water environment. Its use is however limited due to poor photocatalytic properties resulting from its surface properties that can be efficiently enhanced by means of atmospheric pressure plasma treatment, resulting in targeting various functional groups on its surface. The project will address plasma functionalisation of g-C3N4 deposited by low-cost additive manufacturing on large-area flexible substrates inserted in tubular photocatalytic reactors for wastewater cleaning, focused mainly on the removal of pharmaceuticals and ARGB. The project combines strong know-how of Applicant in plasma material treatment and nanomaterials and know-how of Host, who is a recognised expert in wastewater diagnostics. The project will reflect on inter and multidisciplinary skills of both Applicant and Host, broadening their horizons beyond current expertise. The proposed collaboration will lead to new AOP protocols for low-cost environmentally friendly water disinfection, tested in the laboratory and industrial conditions and thus with the potential to have an impact on the water cleaning industry.

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PUBLICATIONS

Homola, T., Dzik, P., Veselý, M., Kelar, J., Černák, M., & Weiter, M. (2016). Fast and low-temperature (70 °C) mineralization of inkjet printed mesoporous TiO2 photoanodes using ambient air plasma. ACS Applied Materials and Interfaces, 8(49), 33562–33571. https://doi.org/10.1021/acsami.6b09556

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Homola, T., Pospisil, J., Shekargoftar, M., Svoboda, T., Hvojnik, M., Gemeiner, P., Weiter, M., & Dzik, P. (2020). Perovskite Solar Cells with Low-Cost TiO2 Mesoporous Photoanodes Prepared by Rapid Low-Temperature (70 °c) Plasma Processing. ACS Applied Energy Materials, 3(12). https://doi.org/10.1021/acsaem.0c02144

Homola, T., Prukner, V., Hoffer, P., & Šimek, M. (2020). Multi-hollow surface dielectric barrier discharge: an ozone generator with flexible performance and supreme efficiency. Plasma Sources Science and Technology, 29, 095014. https://doi.org/10.1088/1361-6595/aba987

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S A S P R O 2

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