FACULTY OF BIOSCIENCE ENGINEERING

The Chancellor of Ghent University has the honour of inviting you to attend the public defense of the doctoral dissertation of

Xu Zhang

Title of the doctoral dissertation:

Electroactive biofilms: novel tools and insights towards charge storage

The public defence will take place on June 28th, 2019 at 17:00 in the August Vermeylen room of "Het Pand", Onderbergen 1, 9000 Ghent.

There will be a contiguous reception to which you are heartily invited.
Please confirm your attendance before June 18th to: Xu.Zhang@UGent.be

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Abstract of the doctoral research

Electroactive bacteria 'catalyze' bioelectrochemical reactions and can form electronically conductive biofilms on polarized electrodes. Envisioned applications for electroactive biofilms (EABs) encompass small power production (e.g. for sensor systems), bioproduction, biosensing and bioremediation. However, their technical applications are often hampered by the low current densities achieved with comparison to abiotic systems.

In this research, we have applied an alternative electrochemical method to rapidly assess the charge transport ability of *Geobacter*-dominated anodic EABs to better understand the underlying electron transport mechanisms. We also demonstrated that an appropriate periodic polarization of the electrode during the growth of anodic EABs can substantially improve their electroactivity. The periodic polarization induced development of EABs with a higher concentration of charge carriers compared to continuously polarized EABs, which favors faster electron transport across the EAB and the generation of higher catalytic current densities. Periodically polarized EABs also produced more electric charge than continuously polarized EABs, even when taking into account the time-intervals under open circuit. The EABs grown under periodic polarization presented mushroom-like structures on their top layer in comparison to the flat biofilms grown under continuous polarization. The EAB enhancement was reversible in only few days after polarization modes were shifted. Periodic polarizations also impacted biofilm adhesion and current production under substrate-limiting conditions. We investigated the polarization signal (frequency and duty cycle) to optimize the EAB electroactivity and the rate of charge production. This electrochemical engineering of EAB opens new routes for enhancing the performance of microbial electrochemical systems.

Brief Curriculum Vitae

Xu Zhang obtained both her bachelor degree in Environmental Science and MSc degree in Environmental Engineering from the Harbin Institute of Technology, with an experimental thesis on microbial formation of palladium nanoparticles and their catalytic activity in bio-electrochemical systems. Subsequently, Xu started her PhD in the Center for Microbial Ecology and Technology (CMET) at Ghent University. Her research aimed to improve the performance of anodic electroactive biofilms via electrochemical engineering approaches.

Her work has been presented at international conferences and she has (co-)authored multiple publications in peer-reviewed journals. She received the ISMET discovery award for best scientific paper in 2017, and best poster at the EU-ISMET conference in 2018. One of her papers was selected for the back cover of the Journal of *ChemElectroChem*.