Flagship: Climate change mitigation: Beyond state-of-the-art separation technique for CO2 capture

One of the current societal trends is towards the electrified systems to combat the global warming and CO2 emissions. Future CO2 technologies will follow the same trend and “carbon electro-technologies” would be inevitable in our future sustainable society. In this context, electrochemical-based CO2 capture and release technology (e-CC) using redox-active carriers (RACs) is an emerging technology that is expected to evolve rapidly. The RACs bind with molecular CO2 only in their reduced state (forming a CO2-carrier complex), while they have no affinity to CO2 in their oxidized (neutral) state, leading to CO2 release. Being an electrochemical and modular process, it can be further integrated with the subsequent electrochemical CO2 conversion step. The e-CC technology using RACs is still at its infancy and technological developments in various aspects are needed.

In my research, I will develop novel CO2 sorbent electrodes (**3D electrodes with CO2 highways**) via developing next-generation RACs with intrinsically higher surface area and redox-active sites. I will develop new methods for RAC polymerization/immobilization on the electrode to achieve structures with improved CO2 diffusivity and accessibility to redox-active sites.

I will further enhance the separation efficiency of the e-CC process by integrating it with the novel “**electrochemical gating membrane (E-gates)**”. This will eliminate the crosstalk between the feed and product gas stream, avoiding the detrimental CO2 back diffusion from product (anode side) towards the feed (cathode side).

**About Hanieh Bazyar**

**A person with her arms crossed

Description automatically generated with medium confidence**Hanieh Bazyar is an assistant professor at the department of Chemical Engineering, TNW. Her research activities focus on developing energy-efficient membrane-based separation techniques for application ranging from (waste)water treatment to H2 production/purification and CO2 capture to realize a sustainable future society.

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