Gas-Diffusion Electrocrystallization (GDEX): A versatile technology for the synthesis of (electro)catalytic nanomaterials

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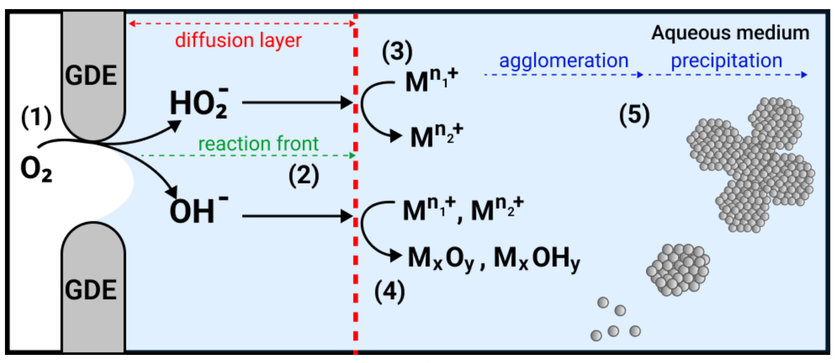
Gas-Diffusion Electrocrystallization (GDEx)

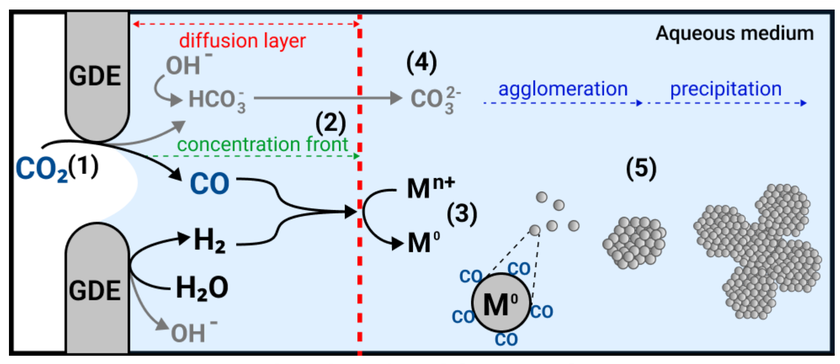
Electrochemical process for the recovery of metals from liquid streams and synthesis of metallic and/or metal oxide nanoparticles (NPs), where reducing or oxidizing agents are produced in-situ during the electrochemical reduction (or oxidation) of a gas in a gas-diffusion electrode (GDE). These agents reacts with metal ions in solution, forming precipitates.

O_2-GDEx



Synthesis of metal (hydr)oxide NPs

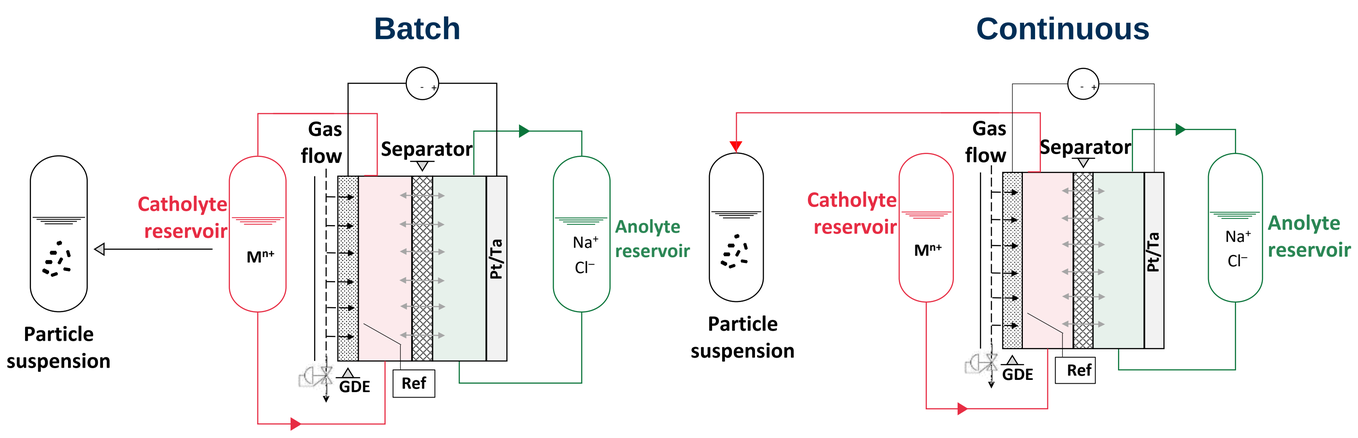
CO_2-GDEX



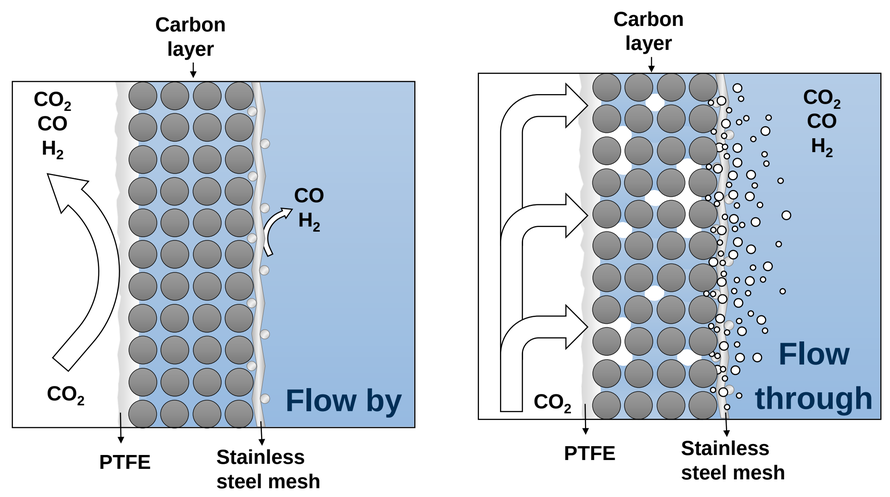
Synthesis of noble metal NPs

Our GDEx publications

GDEx reactor design



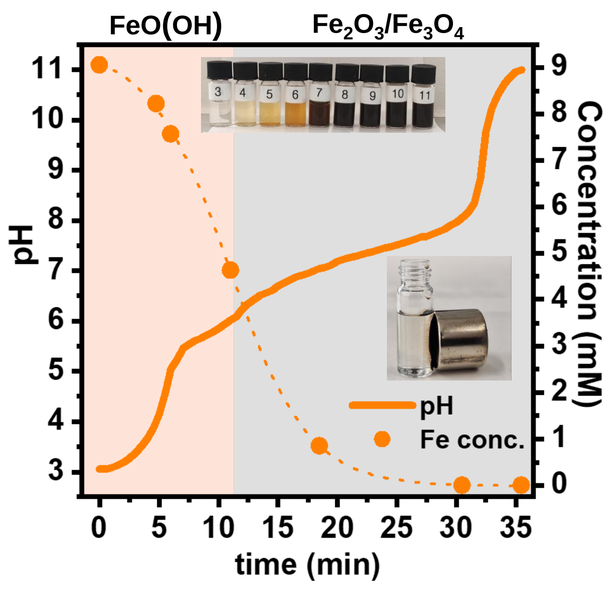
Gas flow regime

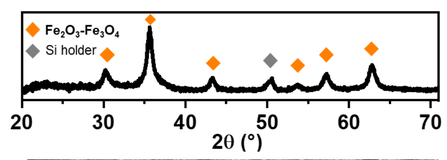


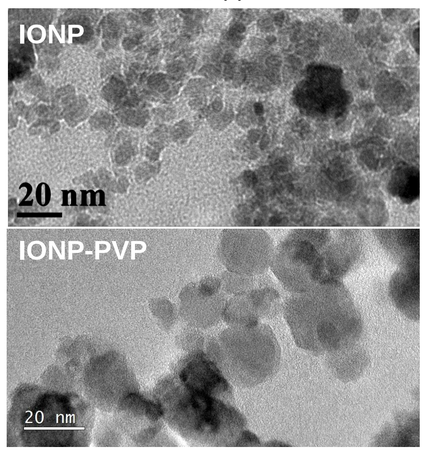
RESULTS

O_2-GDEx

Synthesis of magnetic Fe oxide NPs

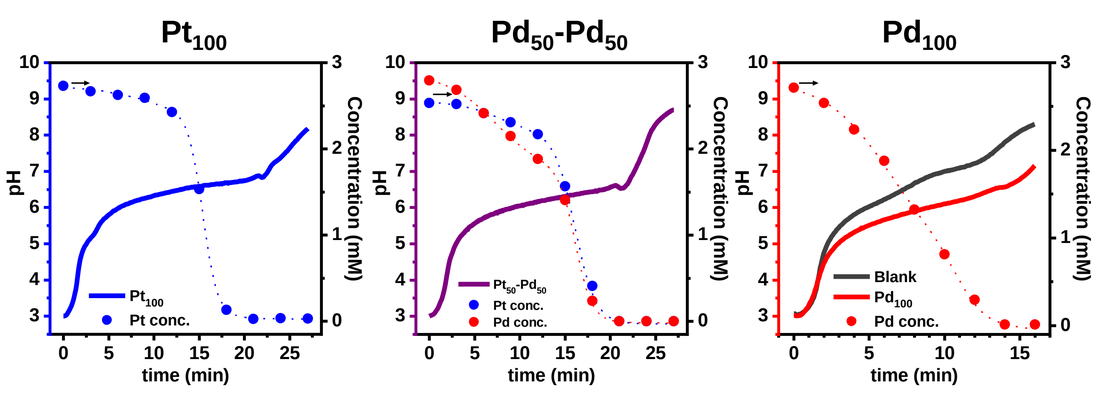


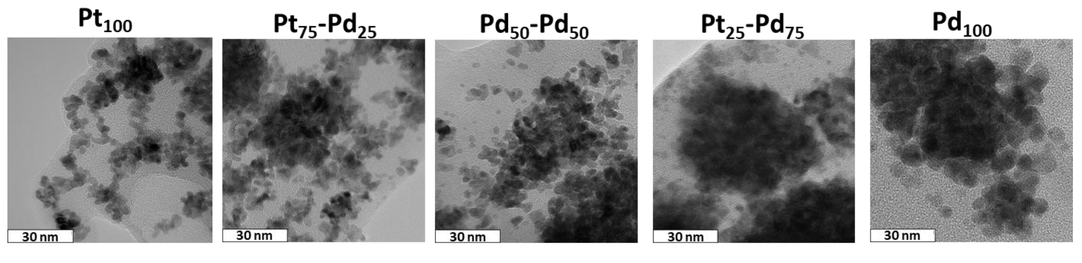




CO_2-GDEx

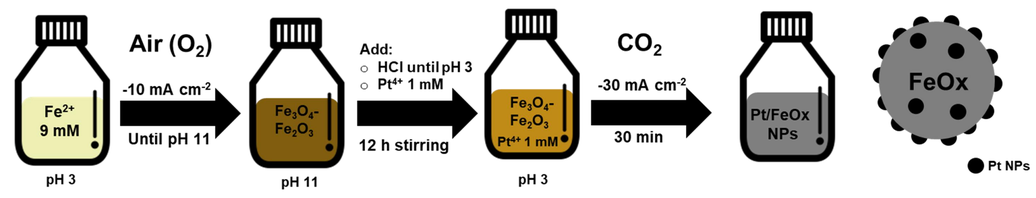
Synthesis of Pt-Pd alloy NPs

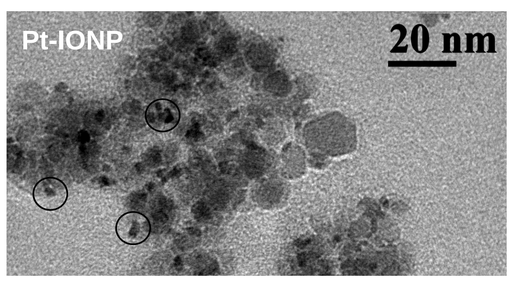


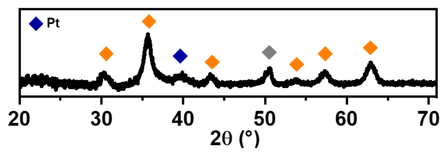


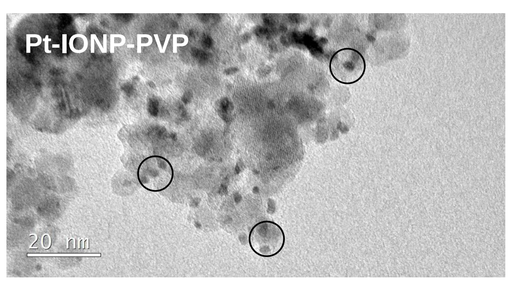
O_2-GDEx and CO_2-GDEx combined

Synthesis of Pt NPs supported in Fe oxide NPs

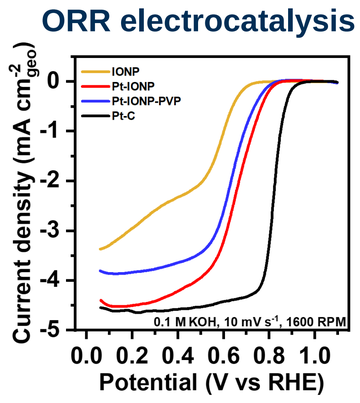




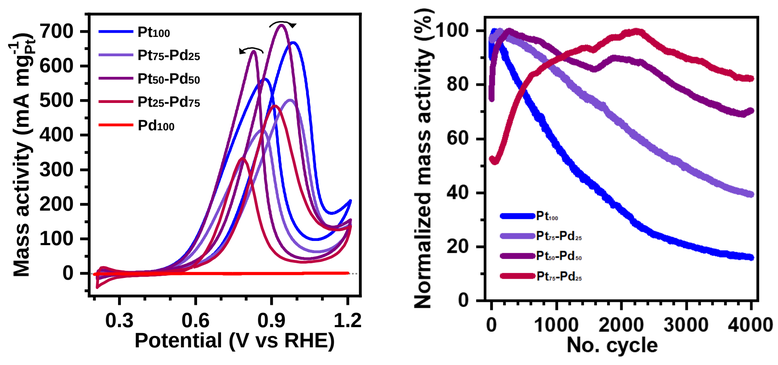




ORR electrocatalysis

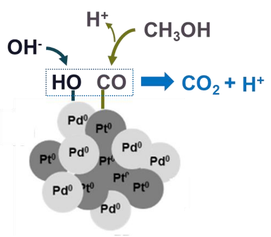


Electrocatalytic activity towards methanol oxidation reaction



Mass activity

Accelerated durability test



CONCLUSIONS

The GDEx process is a **versatile and scalable method for synthesizing nanoparticles**. By adjusting different variables, a wide range of materials can be produced, including metal oxides such as Fe_3O_4, Fe_2O_3, CeO_2, Mn_3O_4, and Co_3O_4, double-layered hydroxides, and noble metal nanoparticles like Pd, Rh, and Au. Additionally, these processes can be combined to create metal oxides/noble metal nanocomposites. **The nanomaterials produced by GDEx can be used in various catalytic applications**, from heterogeneous catalysis to electrocatalysis.

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