Faculty of Engineering and Applied Science
Chemical Engineering Seminar Series

Multifunctional materials: rational design of sustainable nanostructured catalysts for pollution mitigation

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Dupuis Hall, Room 217

The widespread acceleration of renewable energy technologies is of paramount importance to mitigate climate change. However, despite many initiatives and efforts, we are still heavily dependant worldwide on fossil fuels. Bridge technologies, as well as the improvement and optimization of current processes, are therefore still significant tools in our progress towards sustainability. The rational design of sustainable catalysts and materials is critical for the improvement of such technologies. In this work, multifunctional iron-based nanostructured materials are developed for sustainable hydrogen production, as well as for sulfur dioxide capture.

Turquoise hydrogen (H_2), a bridge technology towards greener H_2 production, can be formed directly from methane without carbon dioxide emissions by catalytic cracking. One of the significant challenges of this process is the severe coking of catalysts, which leads to their deactivation and to reactor clogging. By proposing a catalyst that can promote hydrogen production while controlling the carbon allotrope formation during the reaction, carbon nanotubes can be obtained as a valuable by-product. A similar material, made of iron oxide nanoparticles deposited on carbon-based support, is developed to capture sulfur dioxide (SO_2), a toxic and harmful gas that intensively contributes to air pollution. By modifying the surface of graphene oxide or micro cellulose, which are known adsorbents for SO_2, further reactive and adsorptive phenomena could be promoted, and thus the capture capacities of the materials can be improved. In this presentation, the development steps of the above multifunctional materials, which show catalytic activity, will be discussed.