הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Graduate Seminars

Lecture Hall 6, Wolfson Department of Chemical Engineering, January 18, 2016, Monday, 12:45

Gal Tvil

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Catalytic Pollution Reduction for Nitrogen-based Fuels

Anthropogenic effects, particularly fossil fuel consumption, have led to a dramatic increase in global pollution levels and atmospheric greenhouse gas concentration. It is therefore clear that an environmentally friendly and robust global energy system must be established to avoid harmful environmental damage. Renewable energy sources are expected to provide an increasing portion of our global energy demand. However, on a large-scale these ultimately clean sources suffer from fundamental drawbacks such as intermittency and deliverability. These issues can be resolved by converting renewable energy (e.g., solar or wind) into storable and transportable fuels derived from future renewable hydrogen produced from water.

Chemically storing hydrogen in the form of fuels could be achieved primarily via carbon or nitrogen as the principal hydrogen carriers. Such renewable fuel technologies are expected to become key elements in sustainable and practical renewable energy utilization in the future. The thought of a future where a portion of the global energy requirement will be fulfilled by environmentally friendly atmospheric nitrogen fixation, on which renewable hydrogen will be stored, is intriguing.

Previously, a nitrogen-based fuel in the form of an aqueous solution of Urea and Ammonium Nitrate (UAN) was suggested as such an energy carrier. The aqueous UAN fuel consists of worldwide commodities, used mainly as fertilizers. The fuel is safe to handle, store, and transport, making it a suitable candidate for large-scale chemical hydrogen storage.

In this study the integration of a catalytic abatement process was attempted for the first time, to reduce the emission of pollutants evolved during the continuous combustion of aqueous UAN below regulatory standards. To do so a catalyst screening study was carried out in a batch reaction system where several metal oxide and noble metal catalysts were tested. A reduction mechanism over noble metals was suggested and practical working parameters (i.e., residence time, pressure) were connected to the UAN combustion effluent composition, mapping out the region where current, Up-To-Date regulatory pollution standards are met.

Refreshments served at 12:30