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Catalysts for the Conversion of Methane to Liquid Transportation Fuels

Displacing petroleum with methane for decentralized fuel production

Problem Statement:

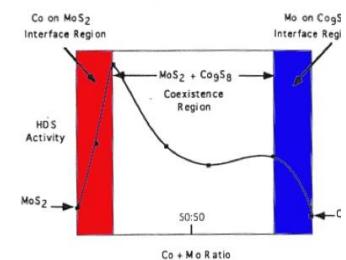
Even though new drilling techniques and technology have tapped into vast natural gas reserves within the United States, current reforming processes need to be done at refineries to convert natural gas into gasoline, diesel, and jet fuel. A key barrier is the cost and logistics of transporting natural gas to refineries. We seek economical pathways to convert natural gas to liquids (GTL) on-site to decentralize fuel production. GTL fuels provide one option among a number of options for light-weight vehicles, but transportation fuel options for jets and ships are limited. Unless new sources of high density liquid fuels emerge, the country will remain dependent on petroleum.

Approach:

In partnership with Exxon Research Laboratories and the University of Texas El Paso, Sandia is developing a technology to convert methane to methanol wherever methane is extracted. Liquid methanol then could be transported to local refineries to produce gasoline, diesel, and jet fuels cost effectively. We have developed transition metal sulfide (TMS) catalytic and photocatalytic processes to cost effectively remove sulfur and nitrogen from petroleum fuels. They have been shown to mimic the activity of expensive noble metals; combinations of TMS such as Ni_3S_2 and MoS_2 interact at interfaces to create more active promoting systems that approach noble metal sulfide catalytic properties. Now, we are investigating transition metal sulfides, oxides, and carbides to drive methane-to-methanol GTL processes.

Impact:

New TMS catalysts enable gas-to-liquid (GTL) refining processes that would create a distributed and domestic liquid transportation fuel supply and take advantage of the US competitive advantage in fracking for methane production.



Converting natural gas to methanol on-site reduces the cost of reforming to gasoline, opens up new uses of fracking resources, and produces a much needed alternative to petroleum dependency.

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