Researchers develop "game-changing" gas separation membrane

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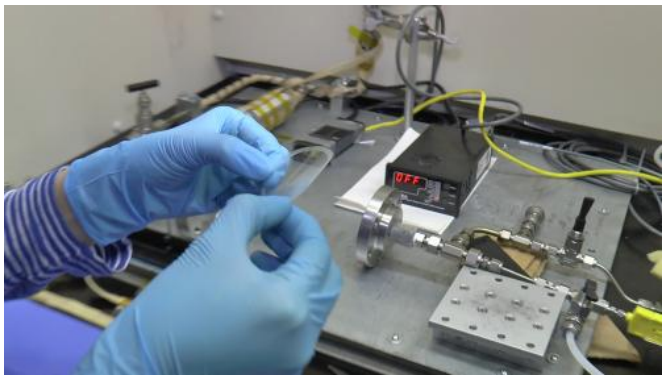

(Phys.org) —Refining, whether oil or natural gases, can be a costly process because of the need to remove impurities found when extracting them from the ground. Currently expensive materials are used to handle this process.

Texas A&M engineering professors Jaime C. Grunlan and Benjamin A. Wilhite have developed a completely new "game-changing" gas separation membrane that will make the process of extracting these impurities easier, and more importantly, less expensive.

Their work was published recently in the journal *Advanced Materials* with the title "Highly size-selective ionically crosslinked multilayer polymer films for light gas separation." They have also filed a patent for this technology due to its commercial potential.

"We use a simple polymer-based film to remove the impurities and it has the promise of a less expensive method for producing purer oil," said Wilhite, associate professor in the Artie McFerrin Department of Chemical Engineering. "It is all polymer and we are able to get performances comparable to really expensive materials such as mixed matrix membranes and zeolites."

"The technology is separating gases," added Grunlan, associate professor in the Department of Mechanical Engineering. "Gas where they mine it is impure and contains different poison gases you don't want. If you run gas through this membrane what comes out is much purer than what went in on the other side."

The membrane that Grunlan and Wilhite have developed is a layer-by-layer polymer coating that is comprised of alternating individual layers of common, low-cost polyelectrolytes.

The coating can be made by dipping or spraying, making it very easy to apply to existing gas separation systems. These films separate molecules based on size, the smaller ones such as hydrogen pass through, while larger ones such as carbon dioxide and nitrogen are slowed down.

"You can have multiple membranes in a row and it would keep getting purer and purer each time it went through the membranes," said Grunlan. "Except for a sheet of metal, nothing has higher selectivity than our coating. This cheap easy coating is the best thing after a pure sheet of metal. The processing is easier and the materials are cheaper."

The oil and gas industry could stand to be one of the main benefactors of the new technology. Both oil and gas contain impurities that have to be filtered.

For example, crude oil comes out of the ground with sulfur. If the amount of sulfur is greater than 0.5 percent the crude is considered "sour." Crude with less than 0.5 percent sulfur is considered "sweet," and is commonly used for processing into gasoline, kerosene and high-quality diesel.

"Traditionally we have operated just off sweet crudes," said Wilhite. "As all the sweet stuff is pretty much gone now, we are increasingly having to tap the holes in the ground we didn't want 50 to 100 years ago."

In order for the "sour" crude to be refined into gasoline, the sulfur has to be removed, which is currently done through hydro treating, an expensive process that in turn leads to higher-priced gasoline.

"You need hydrogen in order to sweeten crudes," Wilhite said. "We can use our membrane right now as a hydrogen purifier, which is valuable because hydrogen is extremely useful in the refining industry."

Provided by Texas A&M University