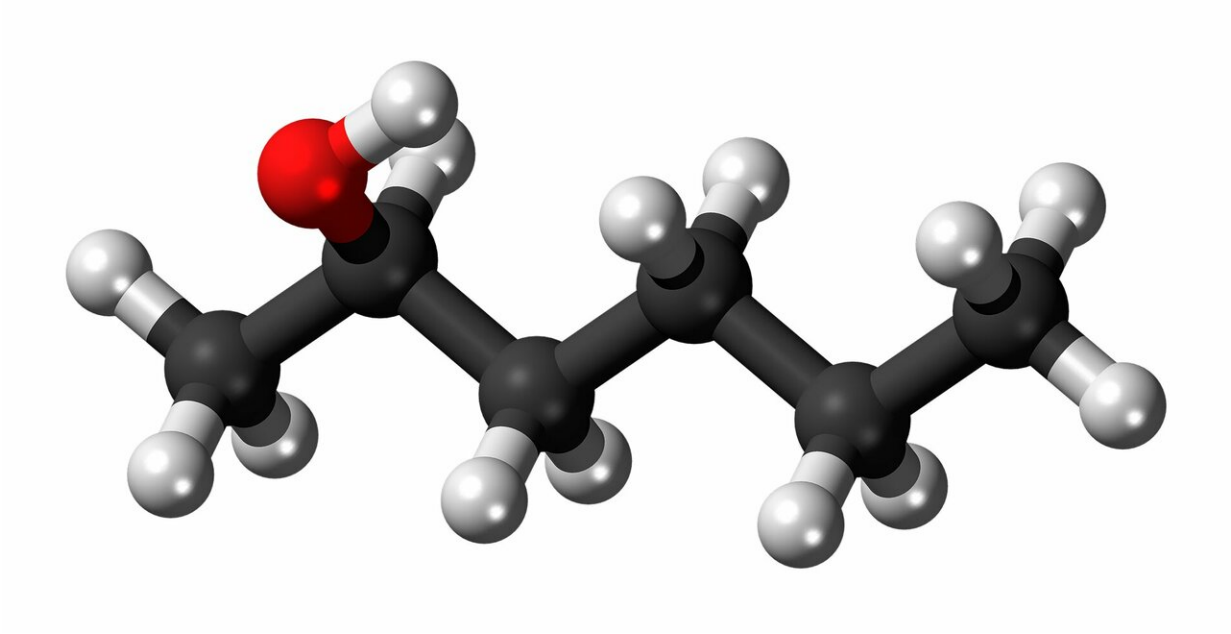
Lego-like assembly of zeolitic membranes improves carbon capture

October 5 2020



Credit: CC0 Public Domain

Zeolites are porous minerals that occur both naturally but also are being synthesized artificially. Because they are stable and durable, zeolites are used for chemical catalysis, purification of gases and liquids, and even in medical applications such as drug delivery and blood-clotting powders, e.g. the QuickClot trauma bandages used in the US military.

Zeolites used in gas separation are usually produced as membranes. The

state-of-the-art zeolitic membranes are manufactured by a lengthy and complex crystallization process. Unfortunately, this method has proved difficult to reproduce. Also, it lacks in producing efficient gas-separation membranes, especially when it comes to the separation of hydrogen and carbon dioxide, which is necessary for pre-combustion carbon capture from power plants.

A team of chemical engineers led by Kumar Agrawal at EPFL Valais Wallis have now successfully simplified the chemistry behind zeolite membrane synthesis, making it straightforward, reproducible, and scalable. The achievement of the longstanding goal is published in *Nature Materials*.

The scientists developed a new material chemistry that eliminates the lengthy crystallization process altogether. "We built Lego-like crystals—nanosheets—and bonded them on top of each other using silanol condensation chemistry," says Agrawal. The resulting membrane shows ideal hydrogen-carbon dioxide separation performance, with selectivity up to 100 at 250-300 degrees Celsius.

The authors conclude, "The scalable synthesis of high-temperature hydrogen-sieving zeolitic membranes is expected to improve the energy-efficiency of pre-combustion carbon capture."

More information: Gas-sieving zeolitic membranes fabricated by condensation of precursor nanosheets, *Nature Materials* (2020). DOI: 10.1038/s41563-020-00822-2 , www.nature.com/articles/s41563-020-00822-2

Provided by Ecole Polytechnique Federale de Lausanne