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Reducing The Cost For Producing High-Purity Hydrogen

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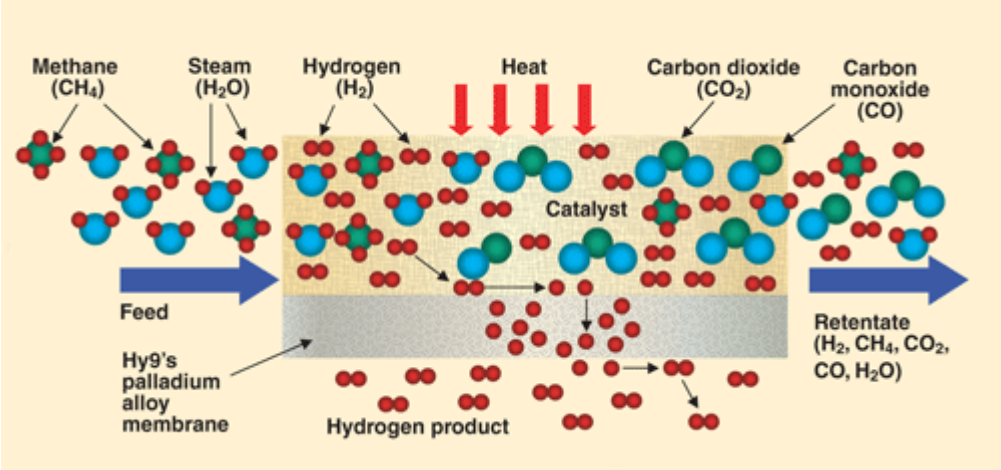

It is well known that palladium membranes are ideal for purifying hydrogen because they allow only H_2 to pass through (via diffusion of H atoms) while blocking all other molecules. Because contaminants cannot pass through this pore-free "filter", Pd membrane separation is especially suitable for ultrahigh–purity applications, such as those in the electronics industry, says Charles Krueger, vice president of product development at Hy9 Corp. (Hopkinton, Mass.; edlinks.che.com/6517-531). However, up to now, the high cost of the precious metal has prevented widespread commercial applications in the industrial H_2 or emerging fuelcell markets, he says.

To reduce costs, Hy9 has developed and patented a method, called chemical thinning, which allows the company to make H_2 purifiers using one–tenth the amount of palladium compared to that used in conventional Pd–Ag–based tubular purifiers, says Krueger. To make the membranes, the company starts with commercially available, 25–μm–thick cold–rolled Pd–alloy foil. The foil is taken through a sequence of chemical etching steps that produces a defect–free membrane that is one half to a quarter of its original thickness. Because the H_2 flux through the membrane is inversely proportional to the Pd thickness, thinner membranes also provide a corresponding increase in throughput, says Krueger.

Plate–and–frame modules containing one or more of the foils are constructed using a patented, diffusion–bonded sealing technique. Hy9 has already commercialized small modules for purifying H_2 from onsite laboratory electrolysis generators (as a replacement– free alternative to cartridge dryers), and is now

expanding its line of purifiers into the ultrahigh–purity, high–purity and fuel–cell markets, says CEO Jeffrey Altman. The company is also developing Pd–membrane separators for use in: methanol reformers (for portable fuel cells); water–gas– shift reactors of steam reformers and coal gasifiers; and single–step, natural gas reformers (diagram). Krueger believes that the technology is cost–effective for applications requiring small (2,000–20,000 ft^3/h) capacities of high–purity H_2, including annealing processes in the metals industries and hydrogenation of natural oils for making fatty acids and alcohols.