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**Review of fuel processing catalysts for hydrogen production in PEM fuel cell systems**

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The rapid development in recent years of the proton-exchange membrane (PEM) fuel cell technology has stimulated research in all areas of fuel processor catalysts for hydrogen generation. The principal aim is to develop more active catalytic systems that allow for the reduction in size and increase the efficiency of fuel processors. The overall selectivity in generating a low CO content hydrogen stream as needed by the PEM fuel cell catalyst is dependent on the efficiency of the catalysts in each segment of the fuel processor. This article reviews the advances achieved during the past few years in the development of catalytic materials for hydrogen generation through fuel reforming,1 water-gas shift and carbon monoxide preferential oxidation, as used or aimed to be of use in fuel processing for PEM fuel cell systems.

# Hydrogen from catalytic reforming of biomass-derived hydrocarbons in liquid water

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Concerns about the depletion of fossil fuel reserves and the pollution caused by continuously increasing energy demands make hydrogen an attractive alternative energy source. Hydrogen is currently derived from nonrenewable natural gas and petroleum1, but could in principle be generated from renewable resources such as biomass or water. However, efficient hydrogen production from water remains difficult and technologies for generating hydrogen from biomass, such as enzymatic decomposition of sugars2,3,4,5, steam-reforming of bio-oils6,7,8 and gasification9, suffer from low hydrogen production rates and/or complex processing requirements. Here we demonstrate that hydrogen can be produced from sugars and alcohols at temperatures near 500 K in a single-reactor aqueous-phase reforming process using a platinum-based catalyst. We are able to convert glucose—which makes up the major energy reserves in plants and animals—to hydrogen and gaseous alkanes, with hydrogen constituting 50% of the products. We find that the selectivity for hydrogen production increases when we use molecules that are more reduced than sugars, with ethylene glycol and methanol being almost completely converted into hydrogen and carbon dioxide. These findings suggest that catalytic aqueous-phase reforming might prove useful for the generation of hydrogen-rich fuel gas from carbohydrates extracted from renewable biomass and biomass waste streams.