Hydrogen Purity – The Largest Barrier to Hydrogen Infrastructure for Fuel Cell Vehicles

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Hydrogen can be produced through many routes, but none are as economically attractive as manufacture from hydrocarbon feedstocks via high temperature catalytic reforming. This technology is dominant in worldwide centralized hydrogen production and distribution, and is the lowest-cost pathway to provide hydrogen during the transition to a hydrogen economy. Unfortunately, the hydrogen purity specifications desired by fuel cell manufacturers exceed current international standard levels of hydrogen quality. Such stringent purity requirements will have extremely negative impacts on the economics and technical viability of hydrogen fuel supply. The technology of purifying hydrogen is discussed along with critical barriers to achieving the desired purity limits. Economic implications of the purity specifications are discussed, most importantly in the area of verification/certification of hydrogen purity. Alternative approaches to meet the required purity are proposed which could offer much-improved economics and technical feasibility.

Keywords:

Pressure Swing Adsorption(PSA): Bulk gas separation technique employing one or more pressure vessels filled with adsorbent material through which an impure feedgas is passed. By cycling between a first and second total pressure, strongly-adsorbed impurity molecules are concentrated in a low-pressure waste gas while weakly-adsorbed species are concentrated in the high pressure product.

PEM Fuel Cell: Electrochemical power source operated between ambient temperature and 120 centigrade which uses hydrogen as fuel and oxygen, generaly from the air, as the oxidant. The electrolyte is a solid ion-exchange polymer film having a high conductiviy for protons, generally a solid superacid such as a sulfonated flouropolymer. The electrochemical reactions are catalyzed by supported noble metals such as platinum.

Getter: A strong adsorbent or absorbent which is used to remove impurities from a gas stream to trace levels. The adsorption or absorption in a getter is often essentially irreversible, and the spent material must be either disposed of or regenerated using a specialized procedure at a central location.

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