CGA H-4—2013

TERMINOLOGY ASSOCIATED WITH HYDROGEN FUEL TECHNOLOGIES

SECOND EDITION

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Work Item 11-014
Hydrogen Technology Committee

NOTE—Technical changes from the previous edition are underlined.

NOTE—Appendix A (Informative) is for information only.

SECOND EDITION: 2013
FIRST EDITION: 2006

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1 Introduction

As hydrogen fuel use becomes more prevalent, terms previously encountered primarily in specialty fields will enter into widespread usage. Additionally, other terms have definitions different from normal usage. Use of consistent terminology would be beneficial.

2 Scope and purpose

2.1 Scope

This publication provides a description of the technologies and terminology as they apply to hydrogen fuel production, storage, transport, and use.

2.2 Purpose

This publication is a single source of uniform terminology for hydrogen fuel technologies. This publication will be useful to persons involved with hydrogen production, storage, transport and use technologies, regulators, and codes and standards developers.

3 Technology descriptions

3.1 Production

3.1.1 Steam reformation

Steam reformation is a chemical reaction between hydrocarbons and steam with the assistance of catalysts to produce hydrogen and carbon monoxide according to the following equation:

$$C_nH_m + nH_2O \rightarrow nCO + \left(n + \left(\frac{m}{2}\right)\right)H_2 \qquad (3.1)$$

The reactions are typically endothermic and kinetically favorable at high temperatures between 1000 °F and 1500 °F (537.8 °C and 815.6 °C). The steam reforming reaction is typically coupled with a lower temperature, exothermic reaction called water gas shift (WGS) to convert the carbon monoxide to carbon dioxide and produce more hydrogen according to the following equation:

$$CO + H_2O \rightarrow CO_2 + H_2 \qquad (3.2)$$

The product gases then pass through a pressure swing adsorption (PSA) bed to purify the hydrogen product. The product hydrogen's purity is typically 99.99% or higher at the end of the purification process. When natural gas or methane is used for the feed, the process is called steam methane reforming (SMR). Figure 1 is a schematic of SMR.

When alcohol is used as a feed, the steam reforming reaction occurs according to the following equation:

$$C_nH_mO + (2n-1)H_2O \rightarrow nCO_2 + \left(2n - 1 + \left(\frac{m}{2}\right)\right)H_2 \qquad (3.3)$$

As with equation 3.2, the product gases pass through a PSA bed where the hydrogen gas is purified.