Hydrogen production by water splitting and chemical reformation using submerged arc discharge in water

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ABSTRACT

Previous studies have revealed that large amount of gases were produced as by-products when underwater arc discharge was employed to produce nanoparticles or nanotubes. Water molecules can be split into hydrogen and oxygen atoms by thermal decomposition at a high temperature, and various molecules such as hydrogen, carbon monoxide, and methane can be reformed with carbon atoms escaped from carbon heating devices. These gases are not completely oxidized and thus are flammable fuels. However, the process of molecule decomposition of water is possible only at a very high temperature above 2000°C which can be accomplished by local heating with either direct joule heating or submerged arc discharge in water. In this work, submerged arc discharge in water was employed to produce fuel gases to study the feasibility of employing this technology to produce fuel gases. In this work, the temperature of arc discharge was accurately determined to be around 2400°C by comparing the radiation spectrum emitted from arc discharge with black body radiation spectra obtained at various temperatures. The produced gases are primarily hydrogen (H2) and carbon monoxide (CO) and are flammable fuel gases. The gases can be utilized directly by feeding them into the existing natural gas network. This technology of water splitting and chemical reformation is not only useful in fuel production and energy transformation, but also important in the large-scale, long-term storage of energy and helpful to the recycling of waste resources. In addition, various hydrocarbons were found in the residual liquid indicating that hydrocarbons were produced as the by-products during the process of submerged arc discharge in water. Further study is required to unambiguously determine the exact chemical composition of these hydrocarbons.

Keywords: Arc Discharge, Water Splitting, Chemical Reformation

REFERENCES