

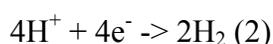
75g Electrolysis of Coal for the Production of Hydrogen

Gerardine G. Botte, Prashanth Patil, Yolanda De Abreu, and Michael Prudich

Introduction

Coal can be used for the production of hydrogen by electrochemical oxidation. Some advantages of the technology are 1. Production of hydrogen at lower cost than the current technology (natural gas reforming) for distributed power, 2. Fuel flexibility, 3. Enhancement of the national security in the United States through less reliance on foreign fuel, and 4. Zero hazardous environmental emissions. In addition, the storage of coal/water slurries is commercially feasible; therefore, the electrolysis of coal/water slurries helps solve the problem of hydrogen storage.

The electrolysis of coal takes place according to the following reactions:¹



where reactions (1) and (2) take place at the anode and cathode, respectively. Downstream separation of the gases is not necessary as pure H₂ and CO₂ are generated in different compartments of the cell. The coal electrolytic cell (CEC) is a reversible fuel cell; furthermore, because of the purity of the hydrogen produced it can be integrated with any other type of fuel cell.

The electrolysis of coal was first investigated in the 1980s.¹⁻⁷ These early studies concluded that the technology was not economically feasible for the production of hydrogen due to the low current densities achieved in the reaction (about 2.5mA/cm² at 1 V and 70 °C). As a result, there was no further intensive study in the next two decades. Recently, the Electrochemical Engineering Research Laboratory (EERL) at Ohio University (OU) developed new catalysts for the electrolysis of coal.^{8,9} Using these new catalysts significantly higher current densities have been observed (30mA/cm² at 0.8 V).

Within this context, the objective of this paper is to evaluate the technical and economical feasibility of producing hydrogen from the electrolysis of coal for distributed power generation using the novel electrodes. These results will be presented at the meeting.

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