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Conference paper

Using MCFC for capturing CO2 from flue gases and delivering to Sabatier reactor for SNG synthesis

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ABSTRACT

In contemporary power generation, enhancing efficiency and mitigating environmental contamination are of paramount importance. The imperative to curtail greenhouse gas emissions stands as a preeminent challenge within this sector. Concurrently, there is a marked surge in the exploitation of renewable energy sources, which, due to their intermittent nature, precipitates the imperative for advanced energy storage solutions. This paper introduces an integrated system designed to address both the reduction of CO2 emissions and the storage of energy. The advocated system integrates a Molten Carbonate Fuel Cell (MCFC), Solid Oxide Electrolysis Cell (SOEC), and a Sabatier reactor. The MCFC is employed for its proficient CO2 capture capabilities at the cathode, exhibiting remarkable efficiency, operational flexibility, and a high CO2 separation quotient. The SOEC is recognized for its effective hydrogen production, leveraging high operational temperatures to augment hydrogen output while diminishing electrical energy consumption through thermal energy substitution. The Sabatier reactor is utilized for catalytic methanation, transforming CO2 into Substitute Natural Gas—a compound predominantly comprising methane and hydrogen with minimal CO2 and water traces. This system facilitates the capture and utilization of over 80% of CO2 from exhaust fumes, achieving an overall energy efficiency of 71%. The system's design and off-design operational parameters were meticulously modeled and analyzed.

1. INTRODUCTION

Although the harmful effect of CO2 on the atmosphere is obvious, its emission hadn't been regulated for many years. However, in 2005 the European Union has initialized European Union Emission Trading

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