SIMULATION STUDIES ON TUBULAR SOLID OXIDE FUEL CELL STACK

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Background:

The solid oxide fuel cell (SOFC) converts chemical energy to electrical energy. It is the promising technology for power generation. The design of a fuel cell system involves more than the optimization of fuel cell unit with respect to efficiency or economics. In this flowsheet, we have tried simulation on tubular solid oxide fuel cell stack using DWSIM.

Description:

The feed (fresh natural gas fuel) is fed to the mixer block (MX-01) into SOFC. The recycling gas split from anode gas (GR-02) using splitter (SP-01). A Gibbs reactor module (GR-01) is selected to stimulate the reforming reactions occurring inside the pre-former. The cooler (C-01) is used to stimulate the temperature decrease. To stimulate the cell reaction, the Gibbs reactor (GR-02) is used. The stoichiometry of the electrochemical reaction is based on the reaction of hydrogen and oxygen. The inlet air is preheated by the hot exhaust from the afterburner (C-01) and enter the cell cathode (CS-01) to provide oxygen for the electrochemical reaction. The convertor (C-01) is used to stimulate the combustion. The heat exchanger (HE-01) is used to exchange heat between the heated exhausted and incoming air.
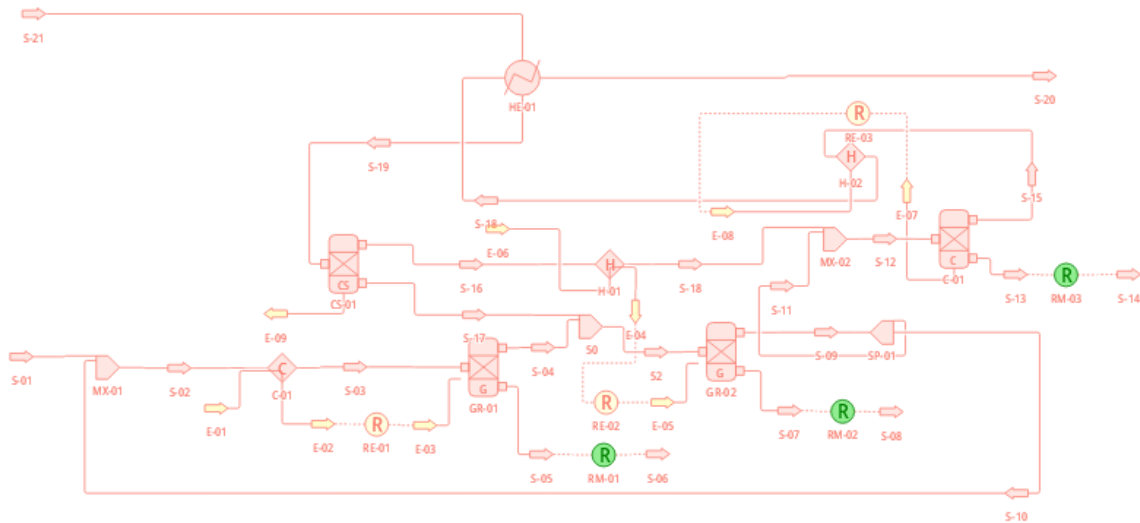
Fig 01:- Tubular solid oxide fuel cells flowsheet

Reference:

W. Zhang et al., Simulation of a tubular solid oxide fuel cell stack using AspenPlusTM unit operation models, Energy Conversion and Management, Volume 46, Issue 2,2005, Pages 181-196, ISSN 0196-8904, https://doi.org/10.1016/j.enconman.2004.03.002.