SOEC Module and SOEC Hydrogen Generation Device Based on Multi-Stack-Core Module

Cross Reference to Related Applications

The present application claims the benefits of Chinese Patent Application No. 202311031308.8 filed on Aug. 16, 2023, the content of which is incorporated herein by reference.

Field

The present disclosure relates to the technical field of hydrogen production by water electrolysis, in particular to an SOEC module and an SOEC hydrogen generation device based on a multi-stack-core module.

Background

There are three main ways to produce hydrogen by water electrolysis with renewable energy sources: alkaline water electrolysis, proton exchange membrane water electrolysis, and solid oxide electrolysis cell (SOEC).

SOEC will be the mainstream technology of water electrolysis for hydrogen production in the future, because it has a higher electrolysis efficiency (90% or above), can be integrated with existing petrochemical installations and make efficient use of the rich waste heat from the petrochemical installations, reduce the power consumption of SOEC installations, and improve the overall efficiency of the system.

In the prior art, the skid-mounted configuration of an SOEC hydrogen generation device based on a multi-stack-core module is generally as follows: an SOEC - stack core and a corresponding heater form a single stack, a plurality of single stacks form an SOEC module, and then a plurality of SOEC modules form an SOEC hydrogen generation device; wherein each SOEC stack core is arranged in a corresponding electric heater, so that the SOEC stack core can be heated to a desired temperature by means of the electric heater.

Through researches, the inventors have found that the skid-mounted configuration of an SOEC hydrogen generation device based on a multi-stack-core module in the prior art still has at least the following defect:

The operating stability of the SOEC hydrogen generation device may be affected because the high-temperature heating element of the electric heater may be damaged easily since the heating element is always in a high temperature state without enough cooling.

The information disclosed in this section is only intended to make the background of the present disclosure understood better, and may not be deemed as acknowledging or implying in any form that the information constitutes the prior art well known to those having ordinary skills in the art.

Summary

The object of the present disclosure is to improve the stability of operation of SOEC hydrogen generation equipment.

The present disclosure provides an SOEC hydrogen generation device based on a multi-stack-core module. The device comprises:

a skid-mounted cabinet provided with a deionized ultra-pure water inlet, a cathode-protection hydrogen inlet, a cold air inlet, a crude hydrogen outlet and an oxygen-rich air outlet, and a steam generator, a mixer, an air heater and a plurality of SOEC modules disposed in the skid-mounted cabinet;

each SOEC module comprises a heat preservation shell provided with a hot air module inlet, a hydrogen-containing mixed steam module inlet, an oxygen-rich air module outlet and a crude