engineering proceedings

CITESCORE 1.2

Conference Report

Conference Report—The 2nd International Conference on Green Aviation (ICGA 2025)

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https://doi.org/10.3390/engproc2024080051

cell/stack. Conventional thermocouples can provide limited information depending its location in the system. The investigation utilized own developed a multi-junction thermal array (MCTA) sensor to read out the true temperature of the SOFCs whilst working. In this work, the sensitivity of MCTA sensor is assessed. It is directly attached to the cathode surface of the anode-supported SOFC to monitor the temperature of the electrode during temperature ramping, OCV changes during anode reduction. MCTA sensor based readings reveals an area-selected reduction process as well as the effects of direct oxidation on cell's local temperature.

Beyond this point to exploit the sensor attached SOC, developed an electrochemical fuel cell based sensor for monitoring of gas contents such as hydrogen, in a hydrogen-natural (H2/NG) gas mixture to determine the calorific value of the H2/NG mixture. This device traces the hydrogen content within the (predominantly methane) stream, and provides an output current reading which correlates to the level of hydrogen in the stream. Present systems for inspecting gas composition to a necessary accuracy (eg. chromatography) are expensive due to their complexity and are not suitable for use in the field, which impedes their wider adoption. Kim and his group are looking to demonstrate an economical, robust and compact sensing platform which consists of H2 sensing and temperature sensing that can be deployed in point-of-use environments.

4.7. Thin Films and Hydrogels for Aviation Electrochromic Devices

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Lecture Summary/Abstract:

Recent years have shown an increased search for new solutions to capture energy from natural and inexhaustible sources such as solar, wind, water, and geothermal. This is because fossil energy sources like oil, coal, and natural gas have limited reserves, and they also have a significant impact on our environment. The new solutions have been implemented, but still, there is a lot of interest, not only from academia but also from industry, in developing new materials that can be used in eco-friendly devices. Electrochromic devices (ECDs) are systems that can change color after applying small potentials, and they are already used in rearview mirrors for cars and airplane windows. They are also installed in some modern buildings to decrease the energy spent on air conditioning. The ECDs can have many different configurations and be obtained using many other materials. Nonetheless, their basic configuration is a sandwich made of electric, color change, and ionic conductivity coatings. These coatings are thin films of transition metal oxides or polymers, and they are deposited on transparent electrodes like ITO or FTO; between them, there is always an electrolyte that can be liquid, solid, or gel. Different thin films of transition metal oxides and the methods they are synthesized and deposited on the glass/ITO substrates are described in the literature. Doping pure metal oxides with other metals improves their electrochemical and optical characteristics. For example, thin films of V2O5 doped with ZnO have shown significant changes in the electrochemical stability, maintaining the redox peaks of the material, and have more effectively preserved the voltammogram area. The cyclic voltammetry of these films has also shown an increase in charge density values for the cathodic and anodic peaks that displayed the vanadium redox potential. The ECDs need an electrolyte, and many papers on gel polymer electrolytes tested in different electrochemical devices have been published already. These electrolytes are very promising because they provide good contact between the electrodes, do not leak, and if obtained from natural polymers or their derivatives they also are environmentally friendly. Furthermore, in the case of natural polymer-based electrolytes, a clay addition can improve their ionic conductivity values. In the case of sodium alginate with 5 wt.% montmorillonite clay that reached 2.77×10^{-3} S/cm^2 at 25 °C and 1.96×10^{-2} S/cm^2 at 70 °C. In summary, thin films of transition metal oxides and natural macromolecules are still attracting attention because of their new application prospects including aviation industry.