

There is great interest in storing the intermittent power generated by various renewable sources such as solar and wind sources. Solid oxide electrolysis cells (SOECs) are able to efficiently use these intermittent energy resources as an input for electrolyzing process (changing intermittent power to fuel for later use). SOECs are also able to reduce the emissions of carbon dioxide to the atmosphere by recycling (or re-using) and converting it to syngas. Syngas (or synthesis gas) is a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, and often some carbon dioxide. Synthesis gases are used as intermediates in creating synthetic natural gas, methanol, synthetic petroleum, and gasoline. Example methods of syngas production involve partial oxidation of either natural gas or liquid hydrocarbons, the gasification of coal, biomass, and co-electrolysis of steam and carbon dioxide using solid oxide electrolysis cells (SOECs). Among these methods, syngas and hydrogen production through a combination of SOECs and power from renewable energy resources an efficient pathway that has several significant advantages. Fuel flexibility, low emissions and large scale production are some benefits attributed to SOECs. SOEC is very similar to a solid oxide fuel cell (SOFC) operated in reverse with similar material sets and geometric configurations. The reverse operation not only changes the reaction directions but also affects the cell electrochemical and thermal behavior, which is relatively far from that observed in SOFCs. This results in a much faster degradation of the cell operating as the SOEC. As a consequence, operating time is too short. For a relatively high-cost production use of the SOEC systems is not economically feasible. The project is planned to investigate degradation processes occurring in the cell, and the development of new materials that will enable to extend the operating time the system. This will increase the competitiveness of the SOEC technology, enabling more efficient use of renewable energy sources.