Project Title:

Accelerated creep test on NRI solid oxide fuel cells to enhance their reliability

Department:	Renewable Energy Research Group	***Employer:***	NRI
Project/Program Manager:	Hamid Abdoli	***Executor:***	Shahriar Bozorgmehri
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Project Staff: Farid Salari

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Project Necessity:

Life-time of 40 kh (>4.5 years) from solid oxide fuel cell stacks is expected. That could be a challenge for development of this technology as implementation of tetsts and related optimizations are very time consuming and costly. Nevertheless, setting the elements and materials in the operating condition and recording data is not the only solution. In the reliability engineering area, accelerated tests are suggested as a solution. In these tests, data acquiring in severe stresses condition are extrapolated to the real operation conditions. Possibility of these tests could be very helpful to predict the life-time and electrical and mechanical responses of materials during service.

Project Goals:

- Simulation of creep behavior of NRI fuel cells
- Setting-up for creep assessments
- Better understanding of accelerated tests on SOFCs
- Implementation of creep tests

Abstract:

Since the expected service life foe solid oxide fuel cells are among 5 to 10 years, durability in long term is a major challenge. . In the reliability engineering area, accelerated tests are suggested as a solution. In this research project, the creep responses of NRI cells were simulated via finite element method. Moreover, creep tests were carried out on the fabricated cells at 700 and 800 °C.

Steps and Methodologies:

- Simulation of creep behavior of NRI SOFCs as the main important mechanical characteristic

- Tabulation of the NRI cells creep data

Main Results (technical outputs, patents, papers, books, reports, etc.):

Due to unsuccessful attempts on fabrication of thermomechanical analyzer apparatus, despite much efforts and time, simulation was performed via finite element method. Also. Creep tests were carried out in another place on NRI SOFCs. If the thermomechanicl analyzer is developed, the technical know how for testing and simulation has been already obtained.

The outcomes of this project were a technical report and an international proceeding paper.