

**FORM 2**

THE PATENTS ACT, 1970  
(39 of 1970)  
AND  
THE PATENTS RULES, 2003

**COMPLETE  
SPECIFICATION**

(See Section 10; rule 13)

TITLE OF THE INVENTION

“HIGH PERFORMANCE FUEL ELECTRODE FOR A SOLID OXIDE  
ELECTROCHEMICAL CELL”

**APPLICANT**

**Technical University of Denmark**  
of Anker Engelundsvej 1, Building 101A, DK-2800 Kgs. Lyngby, Denmark; Nationality:  
Denmark

The following specification particularly describes  
the invention and the manner in which  
it is to be performed

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## Amended claims:

1. A high performance anode (fuel electrode) for use in a solid oxide electrochemical cell, said anode being obtain-  
10 able by a process comprising the steps of:
- (a) providing a doped, stabilized zirconium oxide electrolyte with an anode side having a coating of electronically conductive perovskite  
15 oxides selected from the group consisting of niobium-doped strontium titanate (STN), vanadium-doped STN, tantalum-doped STN and mixtures thereof, thereby obtaining a porous anode backbone,
  - 20 (b) sintering the coated electrolyte at a temperature around 1200°C in air or in a reducing atmosphere,
  - (c) effecting a precursor infiltration of a mixed catalyst into the backbone, said catalyst  
25 comprising a combination of noble metals (Pt and/or Pd and/or Ru) and Ni with rare earth metals, such as Ce or Gd, where the infiltration combinations are binary (Pt-CGO or Pd-CGO or Ru-CGO or Ni-CGO), ternary (Ni-Pt-CGO or Ni-Pd-CGO or Ni-Ru-CGO) or quaternary (Ni-Pd-Ru-  
30 CGO) electrocatalysts, and where the precursors

for infiltration are in chloride or nitrate forms,

- (d) subjecting the resulting structure of step (c) to calcinations in air to form the nano-structured electrocatalyst, including calcinations in several steps with infiltration,
- (e) infiltrating Ni and CGO containing precursors (nitrates) into the backbone of the anode, and
- (f) heat-treating the twice electrocatalyst-infiltrated electrolyte,

**characterised** in that the infiltrations in step (c) are obtained by a process comprising the steps of (1) first infiltrating the STN backbone with Pd-CGO or Pt-CGO or Ru-CGO binary electrocatalyst followed by Ni-CGO binary electrocatalysts to obtain a ternary electrocatalyst combination or (2) first infiltrating the STN backbone with Pd-Ru-CGO ternary electrocatalyst followed by Ni-CGO binary electrocatalysts to obtain a quaternary electrocatalyst combination.

2. Anode structure according to claim 1, wherein the electrolyte is a tape with a thickness of about 120  $\mu\text{m}$  screen-printed with 20  $\mu\text{m}$  STN backbone.

3. Anode structure according to claim 1, wherein the heat treatment step (d) is carried out at a temperature of about 650°C.

4. Anode structure according to claim 1, wherein the heat treatment step (f) is carried out at a temperature of about 350°C.

5. Anode structure according to claim 1, wherein a multi-catalyst is infiltrated in the FeCr-3YSZ backbone by adopting the steps (c)-(f).

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6. Use of the anode structure according to any of the claims 1-5 in a solid oxide fuel cell (SOFC).

7. Use of the anode structure according to any of the claims 1-5 in a solid oxide electrolyser cell (SOEC), in which case it is a cathode.

8. Use of the anode structure according to any of the claims 1-5 in a high temperature (600 to 850°C) operating SOEC or SOFC.

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Arindam Paul  
REG.NO:IN/PA-174  
of Depenning & Depenning  
Agent for the Applicants