US008241817B2

(12) **United States Patent**
Yang et al.

(10) **Patent No.: US 8,241,817 B2**
(45) **Date of Patent: Aug. 14, 2012**

(54) **APPROACH FOR IMPROVED STABILITY AND PERFORMANCE OF SOFC METALLIC INTERCONNECTS**

(75) Inventors: **Zhenguo Yang**, Richland, WA (US); **Jeffry W. Stevenson**, Richland, WA (US); **Guan-Guang Xia**, Pasco, WA (US)

(73) Assignee: **Battelle Memorial Institute**, Richland, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 500 days.

(21) Appl. No.: **12/353,816**

(22) Filed: **Jan. 14, 2009**

(65) **Prior Publication Data**

US 2010/0178586 A1 Jul. 15, 2010

Related U.S. Application Data

(60) Provisional application No. 61/023,291, filed on Jan. 24, 2008.

(51) **Int. Cl.**
H01M 8/02 (2006.01)
H01M 8/12 (2006.01)

(52) **U.S. Cl.** **429/522**; 427/115

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,061,482	A	10/1962	Grant	
3,077,425	A	2/1963	Fromson	
5,942,349	A	8/1999	Badwal et al.	
2004/0101733	A1 *	5/2004	Yamanis et al.	429/34

FOREIGN PATENT DOCUMENTS

EP	1 786 056	A1	5/2007
EP	1850412	*	10/2007
WO	WO96/28855		9/1996
WO	WO2007-009104	A2	1/2007

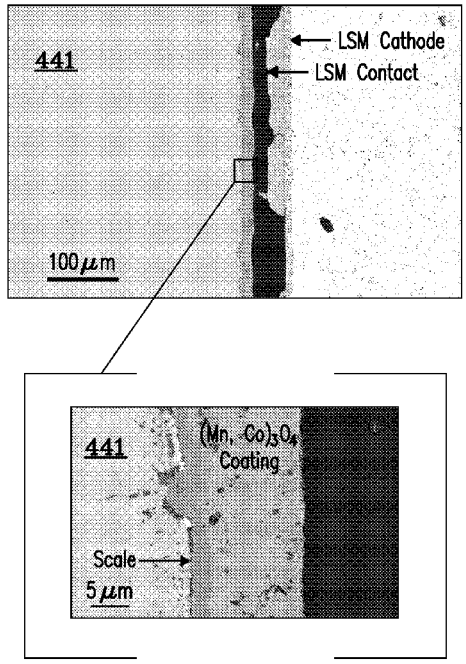
OTHER PUBLICATIONS

S. Seal et al., "Improvement in the oxidation behavior of austenitic stainless steels by superficially applied, cerium oxide coatings," Oxidation of Metals 41:1-2, Feb. 1, 1994, abstract.*
Larring, Yngve, et al., Journal of the Electrochemical Society, 147 (9) (2000), pp. 3251-3256.
Yang, Zhenguo, Journal of The Electrochemical Society, 152 (9) (2005), pp. A1896-A1901.
Yang, Zhenguo, Electrochemical and Solid-State Letters, 8 (3) (2005) A168-A170.
Chen, Xuan, Solid State Ionics 176 (2005) 425-433.
International Search Report/Written Opinion, dated Jul. 2009 for PCT/US2009/031106.

* cited by examiner

Primary Examiner — Jonathan Crepeau
(74) *Attorney, Agent, or Firm* — A. J. Gokcek

(57) **ABSTRACT**

The present invention provides a material and a method for its creation and use wherein a reactive element, preferably a rare earth element, is included in an oxide coating material. The inclusion of this material modifies the growth and structure of the scale beneath the coating on metal substrate and improves the scale adherence to the metal substrate.

12 Claims, 3 Drawing Sheets