IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

In re U.S. Patent No. 7,060,360

Filed: May 22, 2003

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Inventors: Harry E. Eaton, Ellen Y. Sun, Stephen Chin

Assignee: United Technologies Corporation

Title: Bond Coat for Silicon Based Substrates

DECLARATION OF ANDREAS M. GLAESER, PH.D.

I, Andreas M. Glaeser, make this declaration in connection with the petition for *inter partes* review submitted by Petitioner for U.S. Patent No. 7,060,360 ("the 360 Patent"). All statements made herein of my own knowledge are true, and all statements made herein based on information and belief are believed to be true. Although I am being compensated for my time in preparing this declaration, the opinions articulated herein are my own, and I have no stake in the outcome of this proceeding or any related litigation or administrative proceedings.

I. INTRODUCTION

1. I am making this declaration at the request of the General Electric Company in the matter of the *Inter Partes* Review of U.S. Patent No. 7,060,360

("the 360 Patent") to Eaton et al.

2. In the preparation of this declaration, I have reviewed the relevant portions of the following documents:

GE-1001	U.S. Patent No. 7,060,360 to Eaton et al.
GE-1002	Prosecution File History of U.S. Patent No. 7,060,360
GE-1005	U.S. Patent No. 5,677,060 to Terentieva et al ("Terentieva").
GE-1006	U.S. Patent No. 6,387,456 to Eaton et al ("Eaton 456").
GE-1007	A.K. Vasudévan & J.J. Petrovic, *A Comparative Overview of Molybdenum Disilicide Composites*, Materials Science and Engineering, vol. A155, Nos. 1-2 (Jun. 1992), pp. 1-17.
GE-1008	European Patent App. No. 1142850 A1 to Wang et al. ("Wang").
GE-1009	U.S. Patent No. 6,517,341 to Brun et al. ("Brun").
GE-1010	D.R. Clarke & C.G. Levi, *Materials Design for the Next Generation Thermal Barrier Coatings*, 33 Annu. Rev. Mater. Res., Apr. 18, 2003, pp. 383-417.
GE-1011	K.N. Lee, *Current Status of Environmental Barrier Coatings for Si-Based Ceramics*, Surface and Coatings Technology, vols. 133-134 (Nov. 200), pp. 1-7.
GE-1012	N. Bornstein, *Oxidation of Advanced Intermetallic Compounds*, Journal de Physique IV, vol. 3, No. C9, (Dec. 1993), pp. C9-367-73.
GE-1013	U.S. Patent No. 5,985,470 to Spitsberg et al. ("Spitsberg").
GE-1014	K.N. Lee et al., *Environmental Barrier Coatings for Silicon-Based Ceramics*, High Temperature Ceramic Matrix Composites, 4th Int'l Conf. on High Temp. Ceramic Matrix Composites (HT-CMC4), Oct. 1-3, 2001.
GE-1015	R. Gibala et al., *Mechanical behavior and interface design of $MoSi_2$-based Alloys and Composites*, Mater. Sci. Eng., vol. A155, No. 1-2 (Jun. 1992), pp. 147-158.

GE-1016	Dilip M. Shah, *$MoSi_2$ and Other Silicides as High Temperature Structural Materials*, Superalloys, (1992), pp. 409-422.
GE-1017	J.-C. Zhao & J. H. Westbrook, *Ultrahigh-Temperature Materials for Jet Engines*, MRS Bulletin, vol. 28, No. 9, (Sep. 2003), pp. 622-26.
GE-1018	M. Tsirlin et al., *Experimental Investigation of Multifunctional Interphase Coatings on SiC Fibers for Non-Oxide High Temperature Resistant CMCs*, High Temperature Ceramic Matrix Composites, 4th Int'l Conf. on High Temp. Ceramic Matrix Composites (HT-CMC4), Oct. 1-3, 2001.
GE-1019	Nathan S. Jacobson, *Corrosion of Silicon-Based Ceramics in Combustion Environments*, J. Am. Ceram. Soc., vol. 76, No. 1, (Jan. 1993), pp. 3-28.
GE-1020	Paul J. Jorgensen et al., *Effects of Water Vapor on Oxidation of Silicon Carbide*, J. Am. Ceram. Soc., vol. 44, No. 6 (Jun. 1961), pp. 258-61.
GE-1021	Yongdong Xu et al., *Oxidation Behavior and Mechanical Properties of C/SiC Composites with Si-$MoSi_2$ Oxidation Protection Coating*, J. Mater. Sci., vol. 34, No. 24, pp. 6009-14 (Dec. 1999).
GE-1022	S. Kamakshi Sundaram et al., *Molten Glass Corrosion Resistance of Immersed Combustion-Heating Tube Materials in E-Glass*, J. Am. Ceram. Soc., vol. 78, No. 7 (Jul. 1995), pp. 1940-46.
GE-1023	Y. L. Jeng, E. J. Lavernia, *Review Processing of Molybdenum Disilicide*, J. Mater. Sci., vol. 29, No. 10, pp. 2557-71 (Jan. 1994).
GE-1024	Yoshikazu Suzuki et al., *Improvement in Mechanical Properties of Powder-Processed $MoSi_2$ by the Addition of Sc_2O_3 and Y_2O_3*, J. Am. Ceram. Soc., vol. 81, No. 12 (Dec. 1998), pp. 3141-49.
GE-1025	J. D. Webster et al., *Oxidation Protection Coatings for C/SiC Based on Yttrium Silicate*, J. Eur. Cer. Soc., vol. 18, No. 16 (Dec. 1998), pp. 2345-50.
GE-1026	J.J. Petrovic et al., *Molybdenum Disilicide Materials for Glass Melting Sensor Sheaths*, 25th Annual Conf. on Composites, Advanced Ceramics, Materials, and Structures: A, Ceramic Engineering and Science Proceedings, vol. 22, No. 3 (Jan. 2001), pp. 59-64.

GE-1027	H. Kahn et al., *Fracture toughness of polysilicon MEMS devices*, Sensors and Actuators, vol. 82, No. 1-3 (May 2000), pp. 274-80.
GE-1028	C.L. Muhlstein et al., *A reaction-layer mechanism for the delayed failure of micron-scale polycrystalline silicon structural films subjected to high-cycle fatigue loading*, Acta Materialia, vol. 50, No. 14 (Aug. 2002), pp. 3579-95.
GE-1029	S. Kamakshi Sundaram et al., *Molten Glass Corrosion Resistance of Immersed Combustion-Heating Tube Materials in Soda-Lime-Silicate Glass*, J. Am. Ceram. Soc., vol. 77, No. 6 (Jun. 1994), pp. 1613-23.

3. In forming my opinions expressed below, I have considered the documents listed above, and my knowledge and experience based upon my work in this area as described below.

4. The application that led to the issuance of the 360 Patent was filed on May 22, 2003. I am familiar with the technology at issue and am aware of the state of the art around this time. Based on the technology disclosed in the 360 Patent, a person of ordinary skill in the art ("POSITA") would include someone who has a M.S. degree in Materials Science as well as at least 3-5 years of experience in the field of high temperature materials and composites. My analyses and opinions below are given from the perspective of a POSITA in these technologies in this timeframe, unless stated otherwise.

II. QUALIFICATIONS AND COMPENSATION

5. I am currently a Professor Emeritus in the Department of Materials Science and Engineering at the University of California, Berkeley ("Berkeley") in Berkeley, California. I joined the faculty at Berkeley in 1981, where I concurrently served as Principal Investigator in the Materials Sciences Division of the Lawrence Berkeley Laboratory, and starting in 1998 as an adjunct professor in the Department of Preventative and Restorative Dental Sciences of the School of Dentistry at the University of California at San Francisco.

6. I received a Bachelor of Science in Materials Science and Engineering from the Massachusetts Institute of Technology (MIT) in 1976, and a Sc.D. also in Materials Science and Engineering with an emphasis on Ceramics from MIT in 1981.

7. In 1981, I joined the faculty at Berkeley as an assistant professor of ceramic engineering and principal investigator (faculty scientist) in the Materials Sciences Division of the Lawrence Berkeley Laboratory. After being promoted to associate professor of ceramic engineering in 1988, I was promoted to full professor in the Department of Materials Science and Engineering in 1998. I taught ceramic processing, kinetics and phase transformations, phase diagrams, glass and crystalline ceramics, and thermodynamics for over thirty years, and supervised numerous graduate students on projects related to multiphase materials.

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