



US008038855B2

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

(10) **Patent No.:** **US 8,038,855 B2**
(45) **Date of Patent:** **Oct. 18, 2011**

(54) **ANODE STRUCTURE FOR COPPER ELECTROWINNING**

(75) Inventors: **Scot P. Sandoval**, Morenci, AZ (US);
Casey J. Clayton, Morenci, AZ (US);
Timothy G. Robinson, Scottsdale, AZ (US);
Christopher John Zanotti, North Royalton, OH (US);
Martin Kim Zanotti, Parma Heights, OH (US)

(73) Assignee: **Freeport-McMoran Corporation**, Phoenix, AZ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 240 days.

3,746,631 A	7/1973	Glos	
3,839,179 A	10/1974	Koziol	
3,857,774 A	12/1974	Morton et al.	
3,907,659 A	9/1975	Paige	
3,915,834 A	10/1975	Wright et al.	
3,928,167 A	12/1975	Buoy	
3,972,795 A	8/1976	Goens et al.	
4,014,763 A	3/1977	Lowe	
4,039,403 A	8/1977	Astley et al.	
4,121,994 A *	10/1978	Crippen et al.	29/592.1
4,134,806 A	1/1979	De Nora	
4,186,074 A	1/1980	Perry	
4,211,629 A	7/1980	McCutchen	
4,226,685 A	10/1980	Portal et al.	
4,230,545 A	10/1980	Pregaman	
4,236,978 A	12/1980	Pregaman	
4,251,337 A	2/1981	Orr et al.	
4,260,470 A	4/1981	Fisher	

(Continued)

(21) Appl. No.: **12/432,473**

(22) Filed: **Apr. 29, 2009**

(65) **Prior Publication Data**

US 2010/0276281 A1 Nov. 4, 2010

(51) **Int. Cl.**
C25B 11/02 (2006.01)

(52) **U.S. Cl.** **204/288**; 204/286.1; 204/289;
204/281; 29/745; 29/746; 29/747; 29/755;
29/879

(58) **Field of Classification Search** 204/281,
204/286.1, 288, 289; 29/825, 879, 745, 746,
29/747, 755

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,792,342 A	5/1957	Tuwiner
3,671,415 A	6/1972	King
3,682,798 A	8/1972	Tuddenham et al.

FOREIGN PATENT DOCUMENTS

EP	0 534 011	3/1993
----	-----------	--------

(Continued)

OTHER PUBLICATIONS

The International Search Report and Written Opinion from corresponding PCT Application No. PCT/US2009/044344 dated Jul. 29, 2009.

Primary Examiner — Bruce Bell
(74) *Attorney, Agent, or Firm* — Snell & Wilmer L.L.P.

(57) **ABSTRACT**

An electrode for use in producing copper in either a conventional electrowinning cell or the direct electrowinning cell is provided. The electrode includes a hanger bar and an electrode body coupled with the hanger bar. The electrode body includes at least one conductor rod having a core and an outer layer surrounding the core and a substrate coupled with the conductor rod.

20 Claims, 12 Drawing Sheets

