



US006663689B2

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

(10) **Patent No.:** **US 6,663,689 B2**  
(45) **Date of Patent:** **\*Dec. 16, 2003**

(54) **PROCESS FOR DIRECT ELECTROWINNING OF COPPER**

(52) **U.S. Cl.** ..... 75/744; 205/367; 423/34  
(58) **Field of Search** ..... 75/744; 205/367; 423/34

(75) Inventors: **John O. Marsden**, Phoenix, AZ (US); **Robert E. Brewer**, Safford, AZ (US); **Joanna M. Robertson**, Thatcher, AZ (US); **David R. Baughman**, Golden, CO (US); **Philip Thompson**, West Valley City, UT (US); **Wayne W. Hazen**, Lakewood, CO (US); **Christel M. A. Bemelmans**, Indian Hills, CO (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,917,519 A \* 11/1975 Fisher et al. .... 205/584  
4,093,526 A \* 6/1978 Blanco et al. .... 205/584  
5,223,024 A \* 6/1993 Jones ..... 75/743  
6,451,089 B1 \* 9/2002 Marsden et al. .... 75/744

\* cited by examiner

(73) Assignee: **Phelps Dodge Corporation**, Phoenix, AZ (US)

*Primary Examiner*—Melvyn Andrews

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(74) *Attorney, Agent, or Firm*—Snell & Wilmer, LLP

This patent is subject to a terminal disclaimer.

(57) **ABSTRACT**

A system and process for recovering copper from a copper-containing ore, concentrate, or other copper-bearing material to produce high quality cathode copper from a leach solution without the use of copper solvent extraction techniques or apparatus. A process for recovering copper from a copper-containing ore generally includes the steps of providing a feed stream containing comminuted copper-containing ore, concentrate, or other copper-bearing material, leaching the feed stream to yield a copper-containing solution, conditioning the copper-containing solution through one or more physical or chemical conditioning steps, and electrowinning copper directly from the copper-containing solution, without subjecting the copper-containing solution to solvent extraction.

(21) Appl. No.: **10/238,399**

(22) Filed: **Sep. 9, 2002**

(65) **Prior Publication Data**

US 2003/0019331 A1 Jan. 30, 2003

**Related U.S. Application Data**

(63) Continuation of application No. 09/912,921, filed on Jul. 25, 2001, now Pat. No. 6,451,089.

(51) **Int. Cl.**<sup>7</sup> ..... **C22B 3/06**

**11 Claims, 2 Drawing Sheets**

