



US009447483B2

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

(10) **Patent No.:** **US 9,447,483 B2**
(45) **Date of Patent:** **Sep. 20, 2016**

(54) **SYSTEM AND METHOD FOR PARALLEL SOLUTION EXTRACTION OF ONE OR MORE METAL VALUES FROM METAL-BEARING MATERIALS**

(71) Applicant: **FREEMPORT-MCMORAN CORPORATION**, Phoenix, AZ (US)

(72) Inventors: **Anand Raman**, Phoenix, AZ (US); **Jason M Morgan**, Morenci, AZ (US); **Barbara J Savage**, Silver City, NM (US); **David G Meadows**, Phoenix, AZ (US); **Wayne W Hazen**, Lakewood, CO (US)

(73) Assignee: **FREEMPORT MINERALS 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 375 days.

(21) Appl. No.: **13/837,158**

(22) Filed: **Mar. 15, 2013**

(65) **Prior Publication Data**

US 2013/0206588 A1 Aug. 15, 2013

Related U.S. Application Data

(62) Division of application No. 13/331,699, filed on Dec. 20, 2011, now Pat. No. 8,420,048.

(51) **Int. Cl.**
C22B 3/02 (2006.01)
C25B 9/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **C22B 60/0278** (2013.01); **B01D 11/0488** (2013.01); **C22B 3/0005** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC .. Y02P 10/236; Y02P 10/212; C22B 3/0005; C22B 60/026; C22B 3/02; C22B 9/00; C25C 1/12
USPC 423/8; 204/233

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,614,669 A 1/1927 Greenawalt
1,798,255 A 3/1931 Greenawalt

(Continued)

FOREIGN PATENT DOCUMENTS

EP 1063307 12/2000
JP 2001239139 9/2001

(Continued)

OTHER PUBLICATIONS

International Preliminary Report on Patentability issued from corresponding International Application No. PCT/US2012/069392, dated Apr. 7, 2014.

(Continued)

Primary Examiner — Zulmariam Mendez

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

(57) **ABSTRACT**

The present disclosure relates to a process and system for recovery of one or more metal values using solution extraction techniques and to a system for metal value recovery. In an exemplary embodiment, the solution extraction system comprises a first solution extraction circuit and a second solution extraction circuit. A first metal-bearing solution is provided to the first and second circuit, and a second metal-bearing solution is provided to the first circuit. The first circuit produces a first rich electrolyte solution, which can be forwarded to primary metal value recovery, and a low-grade raffinate, which is forwarded to secondary metal value recovery. The second circuit produces a second rich electrolyte solution, which is also forwarded to primary metal value recovery. The first and second solution extraction circuits have independent organic phases and each circuit can operate independently of the other circuit.

17 Claims, 3 Drawing Sheets

