US009410225B2

(12) **United States Patent**
Salomon-de-Friedberg et al.

(10) **Patent No.: US 9,410,225 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **PROCESS FOR RECOVERY OF COPPER FROM ARSENIC-BEARING AND/OR ANTIMONY-BEARING COPPER SULPHIDE CONCENTRATES**

(71) Applicants: **Teck Resources Limited**, Vancouver (CA); **Aurubis AG**, Hamburg (DE)

(72) Inventors: **Henry Salomon-de-Friedberg**, Richmond (CA); **Hee Mun Jang**, Richmond (CA)

(73) Assignees: **Teck Resources Limited**, Vancouver, British Columbia (CA); **Aurubis AG**, Hamburg (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 340 days.

(21) Appl. No.: **14/276,692**

(22) Filed: **May 13, 2014**

(65) **Prior Publication Data**

US 2015/0329937 A1 Nov. 19, 2015

(51) **Int. Cl.**

C22B 3/00	(2006.01)
C22B 15/00	(2006.01)
C22B 3/08	(2006.01)
C22B 1/11	(2006.01)
C22B 30/02	(2006.01)
C22B 30/04	(2006.01)
C22B 3/26	(2006.01)
C22B 1/00	(2006.01)
C22B 3/06	(2006.01)

(52) **U.S. Cl.**

CPC ***C22B 15/0067*** (2013.01); ***C22B 1/00*** (2013.01); ***C22B 1/11*** (2013.01); ***C22B 3/0005*** (2013.01); ***C22B 3/06*** (2013.01); ***C22B 3/08*** (2013.01); ***C22B 15/00*** (2013.01); ***C22B 15/0071*** (2013.01); ***C22B 30/02*** (2013.01); ***C22B 30/04*** (2013.01); *Y02P 10/236* (2015.11)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,223,024	A	6/1993	Jones
5,232,491	A	8/1993	Corrans et al.
5,316,567	A	5/1994	Jones
5,431,788	A	7/1995	Jones
5,645,708	A	7/1997	Jones
5,855,858	A	1/1999	Jones
5,869,012	A	2/1999	Jones
5,874,055	A	2/1999	Jones
5,902,474	A	5/1999	Jones
5,917,116	A	6/1999	Johnson et al.
5,993,635	A	11/1999	Hourn et al.
6,054,105	A	4/2000	Jones
6,171,564	B1	1/2001	Jones
RE37,251	E	7/2001	Jones
6,383,460	B2	5/2002	Jones
6,455,019	B2	9/2002	Jones
6,471,849	B1	10/2002	Jones
6,676,909	B2	1/2004	Marsden et al.
6,755,891	B2	6/2004	Jones
7,169,371	B2	1/2007	Jones
7,341,700	B2	3/2008	Marsden et al.
7,438,874	B2	10/2008	Jones et al.
8,025,859	B2	9/2011	Jones
8,163,063	B2	4/2012	Manabe
2005/0126923	A1	6/2005	Marsden et al.
2008/0216606	A1	9/2008	Marsden et al.
2011/0283838	A1	11/2011	Jones et al.

FOREIGN PATENT DOCUMENTS

CA	2377779	C	6/2008
WO	9641026	A1	12/1996
WO	03048400	A2	6/2003

OTHER PUBLICATIONS

Hackl, et al., "Effect of sulfur-dispersing surfactants on the oxygen pressure leaching of chalcopyrite", Proceedings of Copper 95-Cobre 95 Internation Conference, vol. III—Electrorefining and Hydrometallurgy of Copper, 1995, pp. 559-577.*

Bruce, R. et al. "Unocking Value in Copper Arsenic Sulphide Resources with the Copper—Arsenic CESL Technology." Hydrocopper Conference Proceedings, 2011, 12 pages.

International Search Report for PCT/CA2015/050317, dated Jul. 22, 2015, 11 pages.

Pease, J.D. et al., "Fine Grinding as Enabling Technology—The IsaMill," Xstrata Technology, Xstrata—Mount Isa Mihnes; Crushing and Grinding, 2005, pp. 1-21.

Hurtado-Guzman et al., "Technical Options for the Treatment of High Arsenic Concentrates. Pyro-Metallurgy v/s Hydro-Metallurgy, the Well Known and Classical Dilemma," Hydrocopper, 2009, pp. 26-36, vol. 26, Antofagasta, Chile.

Riveros, P.A., et al., "Studies on the Leaching of Tennantite, Tetrahedrite and Enargite in Acidic Sulphate and Chloride Media," CANMET-MMSL, Ottawa, Canada, presented at METSOC's Cu2007 The John E. Dutrizac International Symposium on Copper Hydrometallurgy, Incorporating the 37th Annual Hydrometallurgy Meeting (in Session 62: Technology Development II), vol. IV, Book 2, pp. 313-331.

Clark, L.W. et al., "Fine Grinding and Project Enhancement," Xstrata Technology, Innovative Mineral Developments Symposium, 2004, pp. 1-18.

Barr, et al., "CESL Copper Process—an Economic Alternative to Smelting," Intermin, 2005, pp. 1-13.

Bolorunduro, S.A., et al.,"Fundamental Study of Silver Deportment During the Pressure Oxidation of Sulphide Ores and Concentrates," Minerals Engineering, 2003, pp. 695-708, vol. 16.

Balaz, P., et al., "Attrition Grinding and Leaching of Enargite Concentrate," Metallwissenschaft und Technik, Jan. 1999, pp. 53-56, vol. 53 (1-2).

* cited by examiner

Primary Examiner — Steven Bos

(74) *Attorney, Agent, or Firm* — Schwabe Williamson & Wyatt

(57) **ABSTRACT**

A process for the extraction of copper from a feed material comprising at least one of arsenic and antimony-bearing copper sulphide minerals is provided. The process includes fine-grinding the feed material and after fine-grinding, subjecting the feed material to pressure oxidation in the presence of surfactant and a halogen to produce a product slurry. The process also includes subjecting the product slurry to liquid/solid separation to obtain a pressure oxidation filtrate and solids comprising at least one of a compound of arsenic and a compound of antimony, and recovering copper from the pressure oxidation filtrate.

20 Claims, 5 Drawing Sheets