US008158545B2

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

(10) **Patent No.: US 8,158,545 B2**
(45) **Date of Patent: Apr. 17, 2012**

(54) **METHODS, SYSTEMS, AND DEVICES FOR DEEP DESULFURIZATION OF FUEL GASES**

(75) Inventors: **Liyu Li**, Richland, WA (US); **David L. King**, Richland, WA (US); **Jun Liu**, Richland, WA (US); **Qisheng Huo**, Richland, WA (US)

(73) Assignee: **Battelle Memorial Institute**, Richland, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 331 days.

(21) Appl. No.: **12/140,798**

(22) Filed: **Jun. 17, 2008**

(65) **Prior Publication Data**

US 2009/0114093 A1 May 7, 2009

Related U.S. Application Data

(60) Provisional application No. 60/944,621, filed on Jun. 18, 2007.

(51) **Int. Cl.**
B01J 20/34 (2006.01)

(52) **U.S. Cl.** **502/20**; 95/135; 95/148; 502/240; 502/258; 502/400; 502/406; 502/407; 502/415

(58) **Field of Classification Search** 95/135; 502/20, 240, 258, 400, 406, 407, 415
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,478,800	A	10/1984	van der Wal et al.
2004/0202597	A1	10/2004	Hesboll et al.
2005/0201920	A1	9/2005	Shan et al.
2005/0258077	A1	11/2005	Landau et al.
2006/0166809	A1	7/2006	Malek et al.

FOREIGN PATENT DOCUMENTS

EP	1447124	A1	8/2004
GB	1351786	A	5/1974
WO	WO 2004045767	A2 *	6/2004

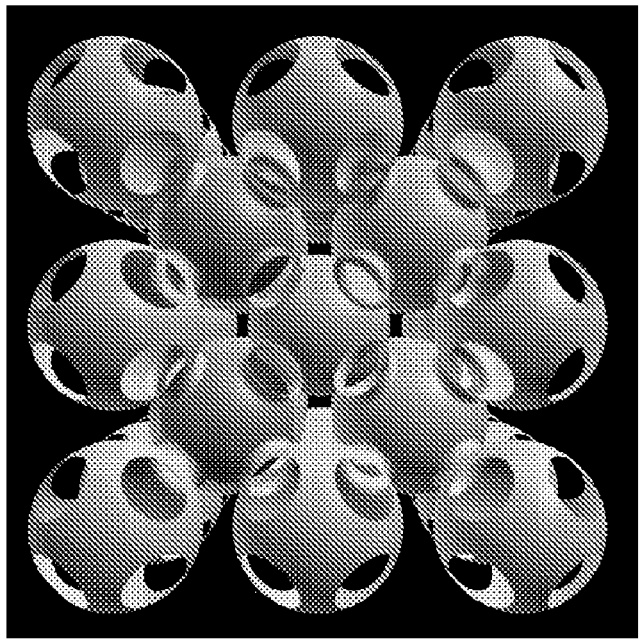
OTHER PUBLICATIONS

PCT Written Opinion/Search Report, 2008.

* cited by examiner

Primary Examiner — Robert J Hill, Jr.
Assistant Examiner — Christopher P Jones
(74) *Attorney, Agent, or Firm* — D. H. Maughan; A. J. Gokcek

(57) **ABSTRACT**

A highly effective and regenerable method, system and device that enables the desulfurization of warm fuel gases by passing these warm gasses over metal-based sorbents arranged in a mesoporous substrate. This technology will protect Fischer-Tropsch synthesis catalysts and other sulfur sensitive catalysts, without drastic cooling of the fuel gases. This invention can be utilized in a process either alone or alongside other separation processes, and allows the total sulfur in such a gas to be reduced to less than 500 ppb and in some instances as low as 50 ppb.

14 Claims, 7 Drawing Sheets