



US007524353B2

(12) **United States Patent**  
**Johnson, Jr. et al.**

(10) **Patent No.:** **US 7,524,353 B2**  
(45) **Date of Patent:** **Apr. 28, 2009**

(54) **DENSIFIED MOLYBDENUM METAL  
POWDER AND METHOD FOR PRODUCING  
SAME**

3,407,057 A	10/1968	Timmons
3,865,573 A	2/1975	Neumann et al.
3,907,546 A	9/1975	Port et al.
4,045,216 A	8/1977	Meyer et al.
4,146,388 A *	3/1979	Lafferty et al. .... 420/429
4,552,749 A	11/1985	McHugh
4,595,412 A	6/1986	Brunelli et al.
4,612,162 A	9/1986	Morgan et al.
4,613,371 A	9/1986	Cheney et al.
4,622,068 A	11/1986	Rowe et al.

(75) Inventors: **Loyal M. Johnson, Jr.**, Tucson, AZ  
(US); **Sunil Chandra Jha**, Oro Valley,  
AZ (US); **Patrick Ansel Thompson**,  
Tucson, AZ (US)

(73) Assignee: **Climax Engineered Materials, LLC**,  
Phoenix, AZ (US)

(Continued)

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 400 days.

**FOREIGN PATENT DOCUMENTS**

JP 58-113369 7/1983

(Continued)

(21) Appl. No.: **11/356,938**

**OTHER PUBLICATIONS**

(22) Filed: **Feb. 17, 2006**

Notification of Transmittal of the International Search Report and the  
Written Opinion of the international Searching Authority, or the  
Declaration of PCT Application No. PCT/US2007/062325 mailed  
Aug. 4, 2008.

(65) **Prior Publication Data**

US 2006/0204395 A1 Sep. 14, 2006

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 10/970,456,  
filed on Oct. 21, 2004, now Pat. No. 7,276,102.

*Primary Examiner*—George Wyszomierski  
(74) *Attorney, Agent, or Firm*—Fennemore Craig, P.C.

(51) **Int. Cl.**  
**B22F 9/22** (2006.01)

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **75/360; 75/369**

(58) **Field of Classification Search** ..... None  
See application file for complete search history.

Densified molybdenum metal powder and method for producing same. Densified molybdenum powder has substantially generally spherical particles, surface area to mass ratio of no more than about 0.5 m<sup>2</sup>/g as determined by BET analysis, and a flowability greater than about 32 s/50g as determined by a Hall Flowmeter. A method for producing densified molybdenum metal powder includes providing a supply of precursor material of molybdenum metal powder particles reduced from ammonium molybdate; providing a supply of reducing gas; densifying the precursor material in the presence of the reducing gas; and producing the densified molybdenum metal powder.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2,398,114 A	4/1946	Rennie
2,402,084 A	6/1946	Rennie
2,776,887 A	1/1957	Kelly, Jr. et al.
3,264,098 A	8/1966	Heytmeijer

**35 Claims, 34 Drawing Sheets**

