



US007207211B2

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

(10) **Patent No.:** **US 7,207,211 B2**  
(45) **Date of Patent:** **Apr. 24, 2007**

(54) **HIGH THROUGHPUT MICROBALANCE AND METHODS OF USING SAME**

(75) Inventors: **Eric D. Carlson**, Cupertino, CA (US);  
**Oleg Kolosov**, San Jose, CA (US);  
**Leonid Matsiev**, San Jose, CA (US)

(73) Assignee: **Symyx Technologies, Inc.**, Santa Clara, CA (US)

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

5,201,215 A *	4/1993	Granstaff et al. ....	73/54.41
5,661,233 A	8/1997	Spates et al.	
5,776,359 A	7/1998	Schultz et al.	
5,792,938 A	8/1998	Gokhfeld	
5,855,849 A	1/1999	Li et al.	
5,959,297 A	9/1999	Weinberg et al.	
6,034,775 A	3/2000	McFarland et al.	
6,041,642 A	3/2000	Duncan	
6,126,311 A	10/2000	Schuh	
6,151,123 A	11/2000	Nielsen	
6,157,449 A	12/2000	Hajduk	
6,175,409 B1	1/2001	Nielsen et al.	
6,182,499 B1	2/2001	McFarland et al.	
6,327,890 B1	12/2001	Galipeau et al.	

(Continued)

(21) Appl. No.: **11/091,607**

(22) Filed: **Mar. 28, 2005**

(65) **Prior Publication Data**

US 2005/0166679 A1 Aug. 4, 2005

**Related U.S. Application Data**

(63) Continuation of application No. 10/155,207, filed on May 24, 2002, now Pat. No. 6,928,877.

(51) **Int. Cl.**  
**G01N 11/00** (2006.01)

(52) **U.S. Cl.** ..... **73/54.41; 73/579**

(58) **Field of Classification Search** ..... **73/597**  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,575,169 A *	11/1951	Green, Jr. ....	73/73
4,103,224 A	7/1978	Taro et al.	
4,294,105 A *	10/1981	Kelly ....	73/28.01
4,312,228 A *	1/1982	Wohltjen ....	73/597
4,535,620 A	8/1985	Cunningham	

FOREIGN PATENT DOCUMENTS

EP 0779510 A2 6/1997

(Continued)

OTHER PUBLICATIONS

U.S. Appl. No. 09/420,334 entitled "Graphics Design of Combinatorial Materials Libraries" (Lacy, et al.) filed Oct. 18, 1999.

(Continued)

*Primary Examiner*—Hezron Williams  
*Assistant Examiner*—Rose M. Miller

(57) **ABSTRACT**

A method and apparatus for measurement of mass of small sample sizes. The method and apparatus is particularly adapted for providing microbalance measurement of solid materials as part of a combinatorial research program. The method and apparatus contemplate monitoring the response of a resonator holding a sample and correlating the response with mass change in the samples.

**24 Claims, 9 Drawing Sheets**

