



US007625474B1

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

(10) **Patent No.:** **US 7,625,474 B1**
(45) **Date of Patent:** **Dec. 1, 2009**

(54) **METHOD FOR A MICROFLUIDIC WEAKLINK DEVICE**

(75) Inventors: **Timothy J. Shepodd**, Livermore, CA (US); **Matthew P. Duncan**, Augusta, GA (US)

6,770,201 B2 8/2004 Shepodd
6,782,746 B1 8/2004 Hasselbrink
6,988,402 B2 * 1/2006 Hasselbrink et al. 73/253
2004/0060864 A1 4/2004 Shepodd
2004/0123658 A1 7/2004 Kirby
2004/0173459 A1 9/2004 Kirby

(73) Assignee: **Sandia Corporation**, Livermore, 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.

(21) Appl. No.: **12/263,905**

(22) Filed: **Nov. 3, 2008**

Related U.S. Application Data

(63) Continuation of application No. 11/021,281, filed on Dec. 23, 2004, now abandoned.

(51) **Int. Cl.**
G01N 27/447 (2006.01)

(52) **U.S. Cl.** **204/450**; 204/451; 422/103

(58) **Field of Classification Search** 204/450-455, 204/600-605; 422/103

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,924,741 A	7/1999	Karlsen	
6,013,164 A	1/2000	Paul	
6,019,882 A	2/2000	Paul	
6,033,544 A	3/2000	Demers	
6,224,728 B1	5/2001	Oborny	
6,277,257 B1	8/2001	Paul	
6,375,901 B1 *	4/2002	Robotti et al.	422/103
6,488,872 B1 *	12/2002	Beebe et al.	264/31
6,770,183 B1	8/2004	Hencken	

OTHER PUBLICATIONS

J. M. Covan; J. A. Cooper; "Predictable Safety in Control of High Consequence Systems", Third IEEE International High-Assurance Systems Engineering Symposium, Nov. 13-14, 1998, Washington, DC.

I. Gitlin; A. D. Stroock; G. M. Whitesides; A. Adjari; "Pumping Based on Transverse Electrokinetic Effects", Applied Physics Letters, 2003, vol. 83, No. 7, pp. 1486-1488.

Studer, et al; "An Integrated AC Electrokinetic Pump in a Microfluidic Loop for Fast and Tunable Flow Control", The Analyst, 2004, vol. 129, No. 10, pp. 944-949.

Nam-Trung Nguyen; Steven T. Wereley; Fundamentals and Applications of Microfluidics, 2002, Artech House, Boston, MA.

* cited by examiner

Primary Examiner—Alex Nogueroles

(74) *Attorney, Agent, or Firm*—Michaelson & Wallace; Timothy P. Evans

(57) **ABSTRACT**

The present invention relates to an electrokinetic (EK) pump capable of creating high pressures electroosmotically, and capable of retaining high pressures. Both pressure creation and retention are accomplished without the need for moving parts. The EK pump uses a polymerizable fluid that creates the pressure-retaining seal within the EK pump when polymerization is initiated, typically by exposure to UV radiation. Weaklink devices are advantageously constructed including such a pressure-retaining EK pump since, among other advantages, the response of the weaklink device relies on predictable and reliable chemical polymerization reactions.

8 Claims, 4 Drawing Sheets

