

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

(10) **Patent No.:** **US 7,478,792 B2**
(45) **Date of Patent:** **Jan. 20, 2009**

(54) **MICROVALVE HAVING MAGNETIC WAX PLUG AND FLUX CONTROL METHOD USING MAGNETIC WAX**

(75) Inventors: **Kwang-wook Oh**, Hwaseong-si (KR);
Kak Namkoong, Seoul (KR);
Chin-sung Park, Yongin-si (KR)

(73) Assignee: **Samsung Electronics Co., Ltd.** (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 411 days.

(21) Appl. No.: **11/396,764**

(22) Filed: **Apr. 3, 2006**

(65) **Prior Publication Data**

US 2006/0219308 A1 Oct. 5, 2006

(30) **Foreign Application Priority Data**

Apr. 2, 2005 (KR) 10-2005-0027829

(51) **Int. Cl.**

F16K 31/00 (2006.01)

F16K 31/18 (2006.01)

(52) **U.S. Cl.** **251/11**; 251/129.01; 137/251.1; 137/828

(58) **Field of Classification Search** 251/11, 251/129.01; 137/251.1, 827, 828

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,375,901 B1	4/2002	Robotti et al.	
6,575,188 B2 *	6/2003	Parunak	137/251.1
6,679,279 B1	1/2004	Liu et al.	137/13
7,195,036 B2 *	3/2007	Burns et al.	137/828
2004/0219732 A1	11/2004	Burns et al.	438/200

OTHER PUBLICATIONS

"Magnetic Fluid and Nanoparticle Applications to Nanotechnology", Author: Markus Zahn, Journal of Nanoparticle Research 3; 73-78, 2001.

* cited by examiner

Primary Examiner—John K Fristoe, Jr.

(74) *Attorney, Agent, or Firm*—Cantor Colburn LLP

(57) **ABSTRACT**

Provided is a microvalve having a magnetic wax plug which includes a micro fluidic structure having an inlet portion and an outlet portion, a magnetic wax plug provided at a predetermined section where the inlet portion and the outlet portion meet, existing in a solid state, melted at a temperature higher than a predetermined temperature, and reversibly moving along a magnetic field, so as to control flux of a fluid through the micro fluidic structure, a heating portion provided corresponding to the section and heating the magnetic wax plug to be melted, and a magnetic field application portion selectively applying a magnetic field to a position where the melted magnetic wax plug arrives.

20 Claims, 7 Drawing Sheets

