

LIS008637222B2

# (12) United States Patent

Tsuchihashi et al.

(10) Patent No.: US 8,637,222 B2 (45) Date of Patent: Jan. 28, 2014

(54)	NEGATIVE RESIST PATTERN FORMING
` ′	METHOD, DEVELOPER AND NEGATIVE
	CHEMICAL-AMPLIFICATION RESIST
	COMPOSITION USED THEREFOR, AND
	RESIST PATTERN

(75)	Inventors:	Toru Tsuchihashi, Shizuoka (JP);		
		Tadateru Yatsuo, Shizuoka (JP); Koji		
		Shirakawa Shizuoka (IP): Hidaaki		

Tsubaki, Shizuoka (JP); Akira Asano,

Shizuoka (JP)

(73) Assignee: FUJIFILM Corporation, Tokyo (JP)

(\*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35

U.S.C. 154(b) by 35 days.

(21) Appl. No.: 13/146,976

(22) PCT Filed: Jan. 29, 2010

(86) PCT No.: **PCT/JP2010/051652** 

§ 371 (c)(1),

(2), (4) Date: Aug. 11, 2011

(87) PCT Pub. No.: WO2010/087516

PCT Pub. Date: Aug. 5, 2010

#### (65) **Prior Publication Data**

US 2011/0287234 A1 Nov. 24, 2011

#### Related U.S. Application Data

(60) Provisional application No. 61/148,517, filed on Jan. 30, 2009.

## (30) Foreign Application Priority Data

Jan. 30, 2009	(JP)	2009-020887
Feb. 20, 2009	(JP)	2009-038665
Mar 31 2009	(IP)	2009-088556

(51) **Int. Cl.** *G03C 5/00* (2006.01)

(52) **U.S. CI.**USPC ....... **430/296**; 430/270.1; 430/311; 430/325; 430/330; 430/331; 430/942

(58) Field of Classification Search

USPC ...... 430/270.1, 296, 311, 325, 330, 331, 430/942

See application file for complete search history.

## (56) References Cited

#### U.S. PATENT DOCUMENTS

5,665,527	A	9/1997	Allen et al.	
7,485,405	B2 *	2/2009	Kato et al.	 430/270.1

2004/0039153 A	.1	2/2004	Elce et al.
2006/0079658 A	.1	4/2006	Kato et al.

2008/0131820 A1 6/2008 Van Steenwinckel et al.

2008/0182087 A1 7/2008 Kato et al.

#### FOREIGN PATENT DOCUMENTS

EP	1 117 002	<b>A</b> 1 7/2001
EP	1 186 624 2	<b>A</b> 1 3/2002
EP	1 953 183 2	42 8/2008
JP	62-175739	<b>A</b> 8/1987
JP	4-134350	<b>A</b> 5/1992
JP	6-112119	<b>A</b> 4/1994
JP	7-140674	A 6/1995
JP	7-199467	A 8/1995
JP	7-226358	A 8/1995
JP	7-261392	A 10/1995
JP	2000-321789	A 11/2000
JP	2000-321791	A 11/2000
JP	3277114 I	32 2/2002
JP	2002-148806	A 5/2002
JP	2002-174908	A 6/2002
JP	2006-133757	A 5/2006
JP	2008-522206	<b>A</b> 6/2006
JP	2006-227174	<b>A</b> 8/2006
JP	2008-26667	A 2/2008
JP		<b>A</b> 8/2008
JP		<b>A</b> 11/2008
JP	2008-286877	A 11/2008
JP	2009-115835	<b>A</b> 5/2009

#### OTHER PUBLICATIONS

Extended European Search Report dated Oct. 29, 2012 in European Application No. 10735970.5.

Search Report from the International Searching Authority, dated Mar. 2, 2010, issued in Application No. PCT/JP2010/051652, English.

Written Opinion from the International Searching Authority, dated Mar. 2, 2010, issued in Application No. PCT/JP2010/051652, English

Office Action dated Nov. 26, 2013, issued by the Japanese Patent Office, in counterpart Japanese Application No. 2010-017489.

Primary Examiner — Christopher Young (74) Attorney, Agent, or Firm — Sughrue Mion, PLLC

# (57) ABSTRACT

A resist pattern forming method including in the following order, (1) a step of forming a film by using a negative chemical-amplification resist composition capable of undergoing negative conversion by a crosslinking reaction, (2) a step of exposing the film, and (4) a step of developing the exposed film by using a developer containing an organic solvent; a developer and a negative chemical-amplification resist composition used therefor; and a resist pattern formed by the pattern forming method.

## 16 Claims, No Drawings

<sup>\*</sup> cited by examiner