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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
G03F 7/30, B05C 11/08, B05D 1/00

A3

(11) International Publication Number: **WO 00/16163**

(43) International Publication Date: 23 March 2000 (23.03.00)

(21) International Application Number: PCT/US99/20115

(22) International Filing Date: 1 September 1999 (01.09.99)

(30) Priority Data:

60/100,738	17 September 1998 (17.09.98)	US
09/221,060	28 December 1998 (28.12.98)	US

(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Applications

US	60/100,738 (CIP)
Filed on	17 September 1998 (17.09.98)
US	09/221,060 (CIP)
Filed on	28 December 1998 (28.12.98)

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(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(88) Date of publication of the international search report:
8 September 2000 (08.09.00)

(54) Title: METHOD AND APPARATUS FOR DEVELOPING PHOTORESIST PATTERNS

(57) Abstract

Systems and methods are described for improved yield and line width performance for liquid polymers and other materials. A method for minimizing precipitation of developing reactant by lowering a sudden change in pH includes: developing at least a portion of a polymer layer on a substrate with an initial charge of a developer fluid; then rinsing the polymer with an additional charge of the developer fluid so as to controllably minimize a subsequent sudden change in pH; and then rinsing the polymer with a charge of another fluid. An apparatus for minimizing fluid impingement force on a polymer layer to be developed on a substrate includes: a nozzle including: a developer manifold adapted to supply a developer fluid; a plurality of developer fluid conduits coupled to the developer manifold; a rinse manifold adapted to supply a rinse fluid; and a plurality of rinse fluid conduits coupled to the developer manifold. The developer manifold and the rinse manifold can be staggered so as to reduce an external width of the nozzle compared to a nominal external width of the nozzle achievable without either intersecting the fluid manifold and the another manifold or staggering the fluid manifold and the another manifold. The systems and methods provide advantages including improve yield via reduced process–induced defect and partial counts, and improved critical dimension (CD) control capability.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/20115

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G03F7/30 B05C11/08 B05D1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G03F B05C B05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 110 558 A (FUJITSU LTD) 13 June 1984 (1984-06-13) page 8, line 20 -page 9, line 8 ---	1-7
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 May 2000	30.05.2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Haenisch, U

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/20115

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 10, 31 October 1996 (1996-10-31) & JP 08 142534 A (KONICA CORP), 4 June 1996 (1996-06-04) abstract	8-12
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INTERNATIONAL SEARCH REPORT

rnational application No.
PCT/US 99/20115

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-17

   method for preventing formation of solids or gels in a developing process by choosing a particular sequence of reactants and/or by introducing additional process steps with the general aim to reduce sudden changes in pH.

2. Claims: 18-43

   developing apparatus comprising means for applying developing and rinsing fluid(s) where the dispensing means is designed to reduce the physical (kinetic) impact of the developing fluid on the target.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/20115

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