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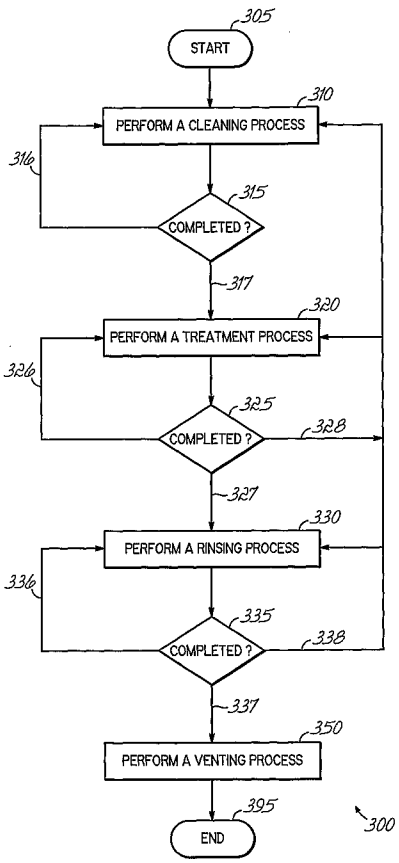
[Continued on next page]

(54) Title: TREATMENT OF SUBSTRATE USING FUCTIONALIZING AGENT IN SUPERCRITICAL CARBON DIOXIDE



(57) Abstract: During the processing of substrates (105), the substrate surface may be subjected to a cleaning process using supercritical CO_2. Surface matter may remain, for example, because it is only minimally soluble in the supercritical CO_2. For example, an oxidation cleaning process causes the substrate structure (105) to cleave at several points leaving smaller fragments of oxidized residue behind. This residue has only minimal solubility in supercritical CO_2 due to the polar constituents resulting from oxidation. The method thus further includes processing the substrate (105) with supercritical CO_2 and a functionalizing agent that can react with the smaller fragments and/or other less soluble components. These functionalized components are rendered more soluble in supercritical CO_2 and are more easily removed than their predecessors.

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International application No
PCT/US2006/017294

A. CLASSIFICATION OF SUBJECT MATTER
INV. G03F7/42 H01L21/3105 H01L21/306 H01L21/321

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)
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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)
EPO-Internal, INSPEC, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/112409 A1 (SCHILLING PAUL E [US]) 17 June 2004 (2004-06-17) page 3, paragraph 38-40 page 5, paragraphs 57,58 page 6, paragraph 66 claims 1,11,12 figure 8	1-21
P,X, L	US 2006/003592 A1 (GALE GLENN [JP] ET AL) 5 January 2006 (2006-01-05) page 6, paragraph 61 claims 1,2,14-16	1,2,6,7, 14,19-21
E,L	US 2006/102204 A1 (JACOBSON GUNILLA [US] ET AL) 18 May 2006 (2006-05-18) claims 1,11-13	1-3,6-8, 14,19

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 October 2006	18/10/2006

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004/008249 A2 (SCP GLOBAL TECHNOLOGIES INC [US]) 22 January 2004 (2004-01-22) page 11, last paragraph page 20, line 3 - page 21, line 4	1-21
A	US 2005/077597 A1 (TOMA DOREL IOAN [US] ET AL) 14 April 2005 (2005-04-14) page 7, paragraph 74 figure 9	1-21
A	WEIBEL G L ET AL: "An overview of supercritical CO2 applications in microelectronics processing" MICROELECTRONIC ENGINEERING, ELSEVIER PUBLISHERS BV., AMSTERDAM, NL, vol. 65, no. 1-2, January 2003 (2003-01), pages 145-152, XP004392358 ISSN: 0167-9317 the whole document	1-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004112409 A1	17-06-2004	AU 2003297212 A1	22-07-2004
		WO 2004059383 A2	15-07-2004
		US 2004177867 A1	16-09-2004
US 2006003592 A1	05-01-2006	WO 2006007005 A1	19-01-2006
US 2006102204 A1	18-05-2006	US 2006102590 A1	18-05-2006
WO 2004008249 A2	22-01-2004	AU 2003253961 A1	02-02-2004
US 2005077597 A1	14-04-2005	EP 1671360 A2	21-06-2006
		US 2005215072 A1	29-09-2005
		WO 2005038863 A2	28-04-2005

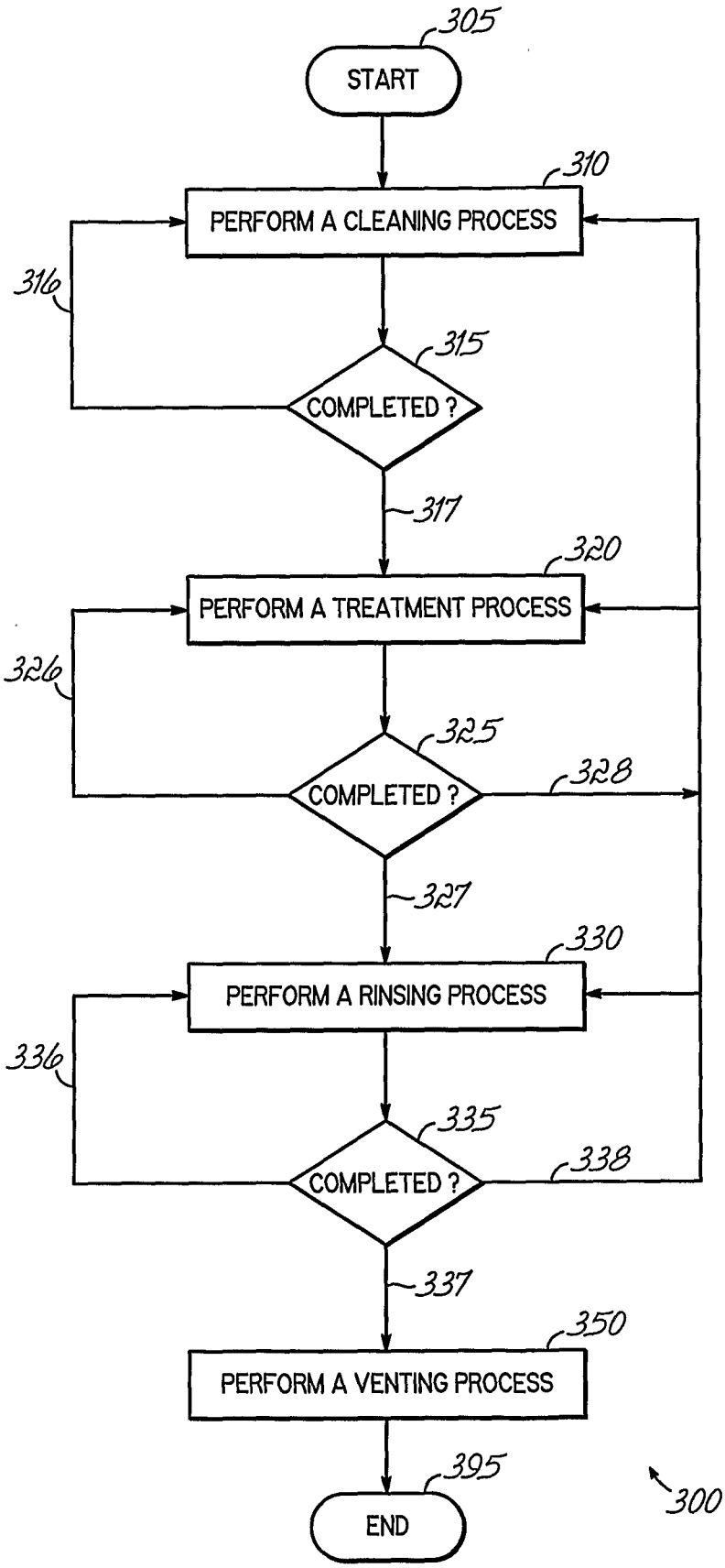
305
START
310
PERFORM A CLEANING PROCESS
316
315
COMPLETED ?
317
320
PERFORM A TREATMENT PROCESS
326
325
COMPLETED ?
328
327
330
PERFORM A RINSING PROCESS
336
335
COMPLETED ?
338
337
350
PERFORM A VENTING PROCESS
395
END
300

FIG. 3