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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/24039

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01M 4/02, 2/16; C08J 3/28; C08F 2/46, 2/48, 2/54, 255/00, 255/04.

US CL : 429/247, 225 223, 250; 442/334, 335; 521/033; 522/ 114, 116, 118, 119, 125; 523/300; 526/201, 286, 287, 328, 329, 329.1, 329.2.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : Please See Continuation Sheet

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 practicable, search terms used)
USPATENTS, DERWENT, EPO, JPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 6,291,105 A (YAMAMOTO ET AL) 18 September 2001, see the Abstract, column 2 to column 3, line 13, column 4, line 58, to column 5, line 15, column 5, lines 54-64, column 6, line 57, to column 7, line 16, column 7, line 48, to column 8, line 29, and Example 1	5-9, 27-30
Y	US 6,037,079 A (TANAKA ET AL) 14 March 2000, Abstract, column 3, line 59, to column 4, line 20, column 4, line 50, to column 5, line 19, column 7, lines 24-50, column 8, lines 40-54, column 11, line 14, to column 12, line 2, column 13, lines 39-50.	1-13, 16-20, 22, 23, 27-30
Y	US 5,798,189 A (HAYASHIDA ET AL) 25 August 1998, Abstract, column 4, line 54, to column 5, line 10, column 7, line 64, to column 8, line 42, column 10, line 17, to column 11, line 50, column 12, lines 10-32 column 15, lines 23-59, and Examples 2 and 6.	1, 2, 5-13, 16-20, 22, 23, 26-30
A	US 5,204,197 A (TAKAI ET AL) 20 April 1993, Abstract, column 4, lines 1-40, and Example 3.	1-30
Y	US 4,376,794 A (MACHI ET AL) 15 March 1983, Abstract, column 2, line 39, to column 3, line 66, column 13, lines 25-59.	1-30
Y,P	US 6,399,247 B1 (KITAYAMA ET AL) 04 June 2002, Abstract, column 13, line 36, to column 14, line 45, column 19, lines 30-51.	13-21, 24, 25



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

18 October 2002 (18.10.2002)

Date of mailing of the international search report

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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	US 6,168,886 B1 (CLOUGH) 02-January 2001, Abstract, column 1, line 60, to column 2, line 15, column 4, lines 51-63, column 6, line 55, to column 7, line 25, column 10, lines 32-48.	14,15,21,24,25

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

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

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim 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. ☐ Claim 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:
Please See Continuation 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.

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-4 and 26, drawn to a method treating a polyolefin sheet to glow discharge plasma or to an electron beam, applying a monomeric solution of vinyl monomer and employing multiple irradiation steps for grafting a vinyl monomer to a polyolefin.

Group II, claim(s) 5-9 and 27-30, drawn to a nonwoven web comprising polyolefin fibers and sheath-core fibers and having polyolefin surface made hydrophilic by exposure to plasma discharge in oxygen, nitrogen or argon.

Group III, claim(s) 10-20 and 22-25, drawn to a method of applying a hydrophilic coating to the polyolefin fibers of a non-woven sheet and a battery separator or battery made by the method.

Group IV, claim(s) 21, drawn to a lead acid battery comprising a battery separator made by subjecting polyolefin fibers in a nonwoven sheet to glow discharge to make the surfaces hydrophilic.

The inventions listed as Groups I-IV do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: With respect to Group I and Group III inventions, graft polymerization of vinyl monomers, including sulfonates, onto a nonwoven sheet of polyolefin fibers does not make a contribution over prior art, as shown by TANAKA ET AL in column 11 or by HAYASHIDA ET AL in column 11, lines 18-50. Grafting by irradiating a polyolefin to provide grafting sites followed by irradiation the polyolefin in the presence of vinyl monomers does not make a contribution over the prior art, as shown by MACHI ET AL in the Abstract. With respect to Group I and Group II and IV inventions, exposure of a polyolefin sheet to plasma discharge to modify the surface properties does not make a contribution over the prior art, as shown by YAMAMOTO ET AL in the Abstract. With respect to Group II, III and IV inventions, nonwoven sheets of dividable polyolefin fibers grafted with vinyl monomers useful as separator material for batteries do not make a contribution over the prior art, as shown by YAMAMOTO ET AL in the Abstract. That each method, separator and battery containing a separator comprises a nonwoven sheet of polyolefin fibers having a hydrophilic surface is not considered to be an inventive concept since nonwoven sheets of polyolefin fibers having a hydrophilic surface do not make a contribution over the prior art. See the citations above. Thus, the inventions of Groups I-IV do not recite a single technical feature that provides a single general inventive concept under PCT Rule 13.1.

Continuation of B. FIELDS SEARCHED Item 1:

429/247, 225 223, 250; 442/334, 335; 521/033; 522/ 114, 116, 118, 119, 125; 523/300; 526/201, 286, 287, 328, 329, 329.1, 329.2.