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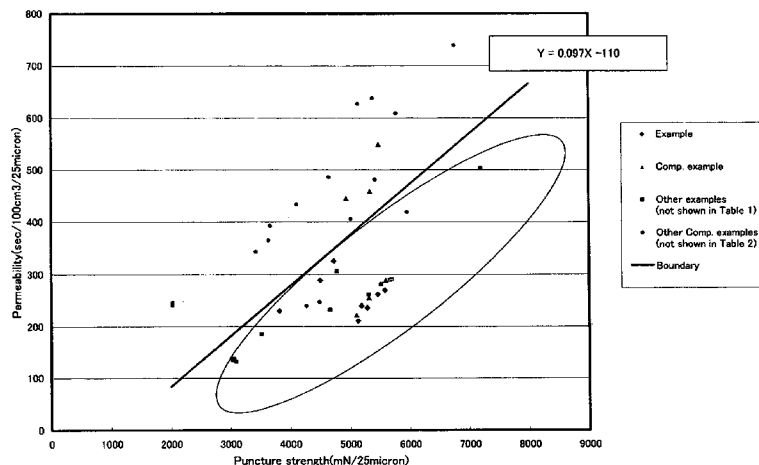
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[Continued on next page]

(54) Title: MICROPOROUS POLYMERIC MEMBRANE, BATTERY SEPARATOR, AND BATTERY

Fig. 1



(57) Abstract: The invention relates to microporous polymeric membrane having a good balance of rupture temperature and air permeability. The invention also relates to a battery separator formed by such a microporous membrane, and a battery comprising such a separator. Another aspect of the invention relates to a method for making the microporous polymeric membrane, a method for making a battery using such a membrane as a separator, and a method for using such a battery.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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24 September 2009

**INTERNATIONAL SEARCH REPORT**

International application No  
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**A. CLASSIFICATION OF SUBJECT MATTER**

INV. B32B5/32      B32B27/32      H01M2/16      B01D69/02      B01D71/26  
       B29C55/00      B01D67/00

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)  
**B32B H01M**

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, WPI Data**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WO 2007/010878 A (TONEN SEKIYUKAGAKU KK [JP]; KIKUCHI SHINTARO [JP]; TAKITA KOTARO [JP];) 25 January 2007 (2007-01-25)                      the whole document                      &amp; EP 1 905 586 A (TONEN SEKIYUKAGAKU KK [JP]; KIKUCHI SHINTARO [JP]; TAKITA KOTARO [JP];) 2 April 2008 (2008-04-02)                      claims 1,2                      paragraphs [0001], [0002], [0030] - [0040], [0047] - [0055], [0064] - [0082]                      examples 1-5</p>	1-16,21
Y	<p>WO 2007/132942 A (TONEN SEKIYUKAGAKU KK [JP]; OZAKI HIROYUKI [JP]; KIMISHIMA KOTARO [JP]) 22 November 2007 (2007-11-22)                      claims 1-21                      paragraphs [0042] - [0049]                      examples 1-10</p>	1-16,21
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*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)
- \*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

- \*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
- \*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
- \*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.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

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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 2007/132943 A (TONEN SEKIYUKAGAKU KK [JP]; OZAKI HIROYUKI [JP]; KIMISHIMA KOTARO [JP]) 22 November 2007 (2007-11-22) claims 1-49 -----	1-16,21
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A	WO 2006/137540 A (TONEN SEKIYUKAGAKU KK [JP]; KIKUCHI SHINTARO [JP]; TAKITA KOTARO [JP];) 28 December 2006 (2006-12-28) the whole document & EP 1 900 514 A (TONEN SEKIYUKAGAKU KK [JP]; KIKUCHI SHINTARO [JP]; TAKITA KOTARO [JP];) 19 March 2008 (2008-03-19) claims 1-7 paragraphs [0043] - [0045] -----	1-16,21
A	WO 2007/049568 A (TONEN SEKIYUKAGAKU KK [JP]; KIKUCHI SHINTARO [JP]; TAKITA KOTARO [JP]) 3 May 2007 (2007-05-03) the whole document & EP 1 942 000 A (TONEN SEKIYUKAGAKU KK [JP]; KIKUCHI SHINTARO [JP]; TAKITA KOTARO [JP];) 9 July 2008 (2008-07-09) claims 1-8 paragraphs [0037] - [0046] -----	1-16,21
P,X	WO 2008/026780 A (TONEN SEKIYUKAGAKU KK [JP]; OZAKI HIROYUKI [JP]; KIMISHIMA KOTARO [JP]) 6 March 2008 (2008-03-06) claims 1-70 -----	1-16,21
P,X	WO 2008/026782 A (TONEN SEKIYUKAGAKU KK [JP]; OZAKI HIROYUKI [JP]; KIMISHIMA KOTARO [JP]) 6 March 2008 (2008-03-06) claims 1-70 -----	1-16,21

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2008/071182

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 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 fees, this Authority did not invite payment of additional fees.
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.:

see additional pages

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- 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: 1-16,21

multi-layer microporous membrane comprising a first layer material comprising polyethylene and a second layer material comprising polypropylene, the polypropylene having (1) a weight-average molecular weight of at least 600000, (2) a heat of fusion of at least 90 J/g, and (3) a MWD in the range of 2 to 6, wherein (a) the multi-layer microporous membrane has at least a first microporous layer containing the first layer material, a third microporous layer containing the first layer material, and a second microporous layer containing the second layer material, the second microporous layer being located between the first and third microporous layers, and (b) the total amount of polypropylene in the multi-layer microporous membrane is at least 2.0 wt.% based on the total weight of the multi-layer microporous membrane, a method for producing it, a battery and a battery separator comprising it.

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## 2. claims: 17-20

microporous membrane having a Rupture temperature of 180°C or higher and comprising polypropylene in a total amount of at least 2 wt.%.

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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