(54) Title: CONJUGATED THIOPHENE COMPOUND, CONPRISING PERFLUORINATED AND ALKYLATED SIDECHAINS, CONDUCTIVE ORGANIC THIN FILM CONTAINING THE COMPOUND, AND FIELD-EFFECT TYPE ORGANIC TRANSISTOR EMPLOYING THE THIN FILM

R₁ R₂
   S   (I)

R₃ R₄
   S   (II)

(57) Abstract: A π-conjugated compound has rings represented by Formulae (I) and (II), an odd number of rings being interposed between the rings of Formula (I), and an odd number of rings being interposed between the rings of Formula (II): where R₁ and R₂ are hydrogen or a substituted or unsubstituted linear, cyclic, or branched alkyl group of 1 to 20 carbon atoms, at least one of R₁ and R₂ being not hydrogen; and R₃ and R₄ are hydrogen or a substituted or unsubstituted linear, cyclic, or branched perfluoroalkyl group of 1 to 20 carbon atoms.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

<table>
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<tr>
<th>IPC</th>
<th>H01B1/12</th>
<th>H01L51/20</th>
<th>H01L51/30</th>
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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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<th>H01L</th>
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

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

EPO-Internal, WPI Data, CHEM ABS Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>COLLARD ET AL. &quot;Controlling the Macromolecular Architecture of Poly(3-alkylthiophene)s by alternating Alkyl and Fluoralkyl Substituents&quot; MACROMOLECULES, vol. 33, 22 April 2000 (2000-04-22), pages 3502-3504, XP002327217 whole document + scheme 2</td>
<td>1,2,4-18</td>
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</table>

Further documents are listed in the continuation of box C.

| X | Patent family members are listed in 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 of other special reason (as specified).
- **O** document relating 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: 9 August 2005

Data of mailing of the international search report: 23.08.2005

Name and mailing address of the ISA:

European Patent Office, P.O. 561B Patentlam 2 NL - 2280 HV Rijswijk, Tel.: (+31-70) 540-2040, Tx. 51 651 epo nl, Fax: (+31-70) 540-3016

Authorized officer: Marsztky, D
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<th>Relevant to claim No.</th>
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<td>A</td>
<td>EP 1 329 474 A (XEROX CORPORATION) 23 July 2003 (2003-07-23) page 1, line 6 - page 19, line 31</td>
<td>1-18</td>
</tr>
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<td>X</td>
<td>EP 1 279 689 A (MERCK PATENT GMBH) 29 January 2003 (2003-01-29)</td>
<td>1,2,4-18</td>
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<td>A</td>
<td>page 1, line 15 - page 9, line 38</td>
<td>3</td>
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</table>
INTERNATIONAL SEARCH REPORT

Box 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 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. [x] 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.

[x] No protest accompanied the payment of additional search fees.

Form PCT/ISA210 (continuation of first sheet (2)) (January 2004)
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1,2,4-18

   Compound (oligomer/polymer) which can be completely conjugated or only partly conjugated comprising a) alkylated thiophene units and b) perfluorinated thiophene units which are separated by c) an odd number of "rings" + their use in organic thin film transistors (OFET)

2. claim: 3

   Purely conjugated compound (oligomer/polymer) comprising a) alkylated thiophene units and b) perfluorinated thiophene units which are separated by c) an odd number of "rings" + their use in organic thin film transistors (OFET)
## INTERNATIONAL SEARCH REPORT

### Information on patent family members

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<th>Patent document cited in search report</th>
<th>Publication date</th>
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<td>JP 2003264327 A</td>
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Form PCT/SA/210 (patent family annex) (January 2004)