(51) International Patent Classification:
    A61L 27/52 (2006.01)    A61L 27/22 (2006.01)

(21) International Application Number:
    PCT/US2011/054937

(22) International Filing Date:
    5 October 2011 (05.10.2011)

(25) Filing Language:    English

(26) Publication Language:    English

(30) Priority Data:
    61/389,765    5 October 2010 (05.10.2010)    US

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(72) Inventors: and


(88) Date of publication of the international search report:
    21 June 2012

(54) Title: NANOSTRUCTURED PHYSICALLY-ASSOCIATING HYDROGELS FOR INJECTABLE, RESPONSIVE AND TOUGH BIOMATERIALS

(57) Abstract: Described herein are block copolymer conjugates that form double-network hydrogels under appropriate conditions. The conjugates comprise a block of polymer end-group, a block of self-associating peptide or protein, and flexible linkers between the two. Hydrogels comprising the conjugates have the mechanical properties, including elastic modulus and fracture toughness, required for load-bearing applications, while maintaining desirable shear-thinning properties, for example, for injectability.

Figure 1
A. CLASSIFICATION OF SUBJECT MATTER

A61L 27/52(2006.01)i, A61L 27/22(2006.01)i

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)

A61L 27/52; A61K 38/00; C07K 5/00; C07K 14/515; A61K 38/18

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: block copolymer, hydro*

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>XU, CHUNYU. Protein-Based Hydrogels Self-Assembled from Genetically Engineered Triblock Polypeptides Containing Coiled-Coil Domains. The University of Utah, August 2006. See the whole document.</td>
<td>1-25,51</td>
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</table>

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 application or patent 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 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

27 APRIL 2012 (27.04.2012)

Date of mailing of the international search report

30 APRIL 2012 (30.04.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer

CHOI Joong Hwan
Telephone No. 82-42-481-5592

Form PCT/ISA/210 (second sheet) (July 2009)
INTERNATIONAL SEARCH REPORT

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. 74-77
   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:

   Claims 74-77 are vague and unclear because they are dependent on claim 73 which does not comply with PCT Rule 6.4(a).

3. ☒ Claims Nos. 26-50, 52-73, 78-79
   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:

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 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.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
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