

**INTERNATIONAL SEARCH REPORT**

International application No. PCT/JP2018/036117
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 Int. Cl. C01B32/158 (2017.01) i, B82Y30/00 (2011.01) i, B82Y40/00 (2011.01) i, C01B32/00 (2017.01) i, C01B32/159 (2017.01) 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)  
 Int. Cl. C01B32/00-32/991, B82Y5/00-99/00, B01J21/00-38/74

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2016-175836 A (NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY) 06 October 2016, abstract, claims, paragraphs [0010]-[0039], [0043]-[0064], [0087]-[0210] & US 2013/0316160 A1, abstract, claims, examples & WO 2012/060454 A1 & EP 2636642 A1 & CN 103201214 A	1-6
A	JP 2011-500497 A (AGENCY FOR SCIENCE TECHNOLOGY AND RESEARCH) 06 January 2011, entire text & US 2010/0279095 A1, entire text & KR 10-2010-0100772 A & TW 200934844 A	1-6

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 but 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 07.11.2018	Date of mailing of the international search report 20.11.2018
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Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer  Telephone 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 2011/099617 A1 (NATIONAL UNIVERSITY CORPORATION HOKKAIDO UNIVERSITY) 18 August 2011, entire text & US 2012/0315459 A1, entire text & CN 102753476 A & KR 10-2013-0035992 A & TW 201137002 A	1-6
A	JP 2014-60158 A (TORAY INDUSTRIES, INC.) 03 April 2014, entire text & US 2015/0010749 A1, entire text & TW 201346406 A & CN 104067354 A	1-6
A	JP 2009-506973 A (SELDON TECHNOLOGIES, LLC) 19 February 2009, entire text & US 2015/0010749 A1, entire text & TW 201346406 A & CN 104067354 A	1-6