

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
28 February 2008 (28.02.2008)

PCT

(10) International Publication Number  
WO 2008/024141 A3

(51) International Patent Classification:  
A61M 5/00 (2006.01) A61M 5/31 (2006.01)  
A61M 5/162 (2006.01)

[CN/US]; 2685 Shore Line Drive, Apt. B-7, Akron, OH 44314 (US).

(21) International Application Number:  
PCT/US2007/011228

(74) Agents: LILLIE, Raymond et al.; Carella, Byrne, Bain, Gilfillan, Cecchi, Stewart & Olstein, 5 Becker Farm Road, Roseland, NJ 07068 (US).

(22) International Filing Date: 9 May 2007 (09.05.2007)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/798,928 9 May 2006 (09.05.2006) US  
60/848,505 29 September 2006 (29.09.2006) US  
60/848,506 29 September 2006 (29.09.2006) US  
60/848,504 29 September 2006 (29.09.2006) US  
60/848,507 29 September 2006 (29.09.2006) US  
60/848,213 29 September 2006 (29.09.2006) US

(71) Applicants (for all designated States except US): APOGEE TECHNOLOGY, INC. [US/US]; 129 Morgan Drive, Norwood, MA 02062 (US). THE UNIVERSITY OF AKRON [US/US]; Goodyear Polymer Center, Suite 312, Akron, OH 44325-2103 (US).

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors; and

(75) Inventors/Applicants (for US only): RENEKER, Darrell, H. [US/US]; 300 Hampshire Road, Akron, OH 44313 (US). SMITH, Daniel, J. [US/US]; 2988 Ridgeline Trail, Stow, OH 44224 (US). MEYERS, David, Barrett [US/US]; 36 Sawmill Road, Walpole, MA 02081 (US). GOLUBOVIC-LIAKOPOULOS, Nevenka [US/US]; 1606 Vroom Drive, Bridgewater, NJ 08807 (US). MARIN, Alexander [RU/US]; 65 Auburn Street, Newton, MA 02466 (US). ANDRIANOV, Alexander, K. [US/US]; 151 Dalton Road, Belmont, MA 02478 (US). CARROLL, Peter, G. [US/US]; 20 Green Street, Canton, MA 02021 (US). SIMON, Sanford, R. [US/US]; 71 Cedar Street, Stony Brook, NY 11790 (US). HAN, Tao

Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- with sequence listing part of description published separately in electronic form and available upon request from the International Bureau

(88) Date of publication of the international search report:  
24 April 2008

(54) Title: NANOFIBER STRUCTURES ON ASPERITIES FOR SEQUESTERING, CARRYING AND TRANSFERRING SUBSTANCES

(57) Abstract: A device which comprises a substrate which includes a plurality of asperities, such as microneedles, extending from the surface of the substrate, and an electrospun material in contact with the substrate. The electrospun material may comprise a plurality of nanofibers which carry at least one biologically active agent. Such devices are useful as transdermal delivery devices for delivering pharmaceuticals and other biologically active agents.



WO 2008/024141 A3

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/11228

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(8) - A61M 5/00, A61M 5/162, A61M 5/31 (2008.01) USPC - 604/46, 604/19, 604/500 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) USPC -- 604/46, 604/19, 604/500 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) WEST -- PGPB,USPT,USOC,EPAB,JPAB; Dialog Classic Files ? 654, 652, 351, 49, 315, 2, 6, 155, 35, 65; Google Scholar; USPTO Web Page; Search terms -- microneedle, substrate, electrospun, polymer, polyethylene oxide, drug delivery, subcutaneous, Clostridium, cytokine, therapeutic protein, anthrax antigen, hormone, subject		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2005/0137531 A1 (PRAUSNITZ et al.) 23 June 2005 (23.06.2005) para [0001], [0011], [0014], [0015], [0039], [0043], [0045], [0075], [0092], [0103], [0185], [0186], [0189]-[0191]	1-13
Y	US 2006/0085063 A1 (SHASTRI et al.) 20 April 2006 (20.04.2006) para [0014], [0031], [0019], [0064], [0089], [0105], [0113], [0174], [0183], [0195], [0215], Fig 4	1-13
Y	US 2006/0057165 A1 (DIMITRAKLOUDIS et al.) 16 March 2006 (16.03.2006) para [0036], [0062]	9
Y	US 2005/0196380 A1 (MIKSZTA et al.) 08 September 2005 (08.09.2005) para [0002], [0012], [0013], [0085], [0161], [0201]	10
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p>		
Date of the actual completion of the international search		Date of mailing of the international search report
13 January 2008 (13.01.2008)		04 MAR 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774