US009410021B2

(12) **United States Patent**
**Nakano et al.**

(10) **Patent No.: US 9,410,021 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **METHOD FOR PRODUCING SURFACE-MODIFIED FLUORORESIN FILM/THERMOPLASTIC RESIN COMPOSITE**

(75) Inventors: **Hiroaki Nakano**, Kobe (JP); **Eiji Yao**, Kobe (JP)

(73) Assignee: **SUMITOMO RUBBER INDUSTRIES, LTD.**, Kobe-Shi (JP)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 383 days.

(21) Appl. No.: **13/616,229**

(22) Filed: **Sep. 14, 2012**

(65) **Prior Publication Data**

US 2013/0168393 A1 Jul. 4, 2013

(30) **Foreign Application Priority Data**

Dec. 28, 2011 (JP) ..... 2011-289525

(51) **Int. Cl.**

| | |
|---|---|
| ***B05D 3/00*** | (2006.01) |
| ***B05D 3/06*** | (2006.01) |
| ***C08J 7/18*** | (2006.01) |
| ***C08J 5/12*** | (2006.01) |
| ***B32B 27/16*** | (2006.01) |
| ***C08J 7/12*** | (2006.01) |
| ***B29C 59/14*** | (2006.01) |
| ***B32B 27/30*** | (2006.01) |
| ***B32B 27/32*** | (2006.01) |
| *B29K 27/12* | (2006.01) |
| *B29K 27/18* | (2006.01) |

(52) **U.S. Cl.**

CPC ..... ***C08J 5/121*** (2013.01); ***B29C 59/14*** (2013.01); ***B32B 27/16*** (2013.01); ***B32B 27/304*** (2013.01); ***B32B 27/322*** (2013.01); ***C08J 7/123*** (2013.01); *B29K 2027/12* (2013.01); *B29K 2027/18* (2013.01); *B29K 2995/0092* (2013.01); *B32B 2250/246* (2013.01); *B32B 2310/0881* (2013.01); *C08J 2327/12* (2013.01); *C08J 2327/18* (2013.01); *C08J 2423/02* (2013.01); *Y10T 428/3154* (2015.04)

(58) **Field of Classification Search**

CPC ..... B32B 27/16; B08J 5/12; B29C 59/14; B29C 66/0224; B29C 65/02; B29C 65/42

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 4,370,187 | A * | 1/1983 | Katagiri et al. | 156/244.23 |
| 7,622,721 | B2 * | 11/2009 | Gutkin et al. | 250/423 R |
| 2010/0170632 | A1 * | 7/2010 | Gautriaud et al. | 156/244.17 |
| 2010/0264139 | A1 | 10/2010 | Kawachi | |

FOREIGN PATENT DOCUMENTS

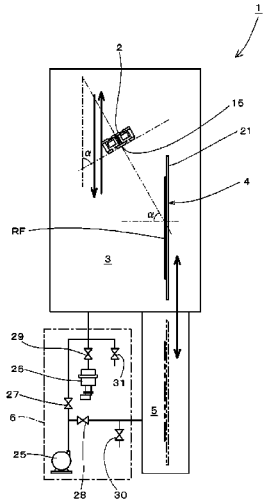
| | | | |
|---|---|---|---|
| JP | 3-243330 | A | 10/1991 |
| JP | 5-116254 | A | 5/1993 |

(Continued)

*Primary Examiner* — Michael Wieczorek

(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

The present invention aims at providing a composite of a surface-modified fluororesin film and a thermoplastic resin bonded to each other, and medical equipment containing the composite. A method for producing a fluororesin/thermoplastic resin composite includes roughening a surface of a fluororesin film by ion beam irradiation from an ion source, and pressure-bonding the surface-modified fluororesin film obtained in the surface roughening step and a thermoplastic resin while maintaining the thermoplastic resin in a fluid state.

**4 Claims, 6 Drawing Sheets**