

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2023/0231273 A1

Takeda et al.

Jul. 20, 2023 (43) **Pub. Date:**

(54) IMPROVED MICROPOROUS MEMBRANE AND DEVICES COMPRISING THE SAME

(71) Applicants: Celgard, LLC, Charlotte, NC (US); ASAHI KASEI KABUSHIKI KAISHA, Tokyo (JP)

(72) Inventors: Hisashi Takeda, Düsseldorf (DE); Kang Karen Xiao, Mississauga (CA); Allen M. Donn, Rock Hill, SC (US); Shinya Hamasaki, Tokyo (JP); Masaki

Takahashi, Tokyo (JP)

(21) Appl. No.: 18/009,342

(22)PCT Filed: Jun. 11, 2021

(86) PCT No.: PCT/US2021/036991

§ 371 (c)(1),

Dec. 9, 2022 (2) Date:

Related U.S. Application Data

Provisional application No. 63/038,555, filed on Jun. 12, 2020.

Publication Classification

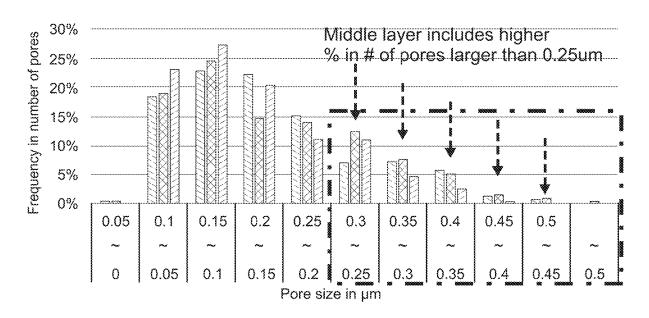
| (51) | Int. Cl. | |
|------|-------------|-----------|
| | H01M 50/457 | (2006.01) |
| | H01M 50/403 | (2006.01) |
| | H01M 50/417 | (2006.01) |
| | H01M 50/489 | (2006.01) |
| | H01M 10/42 | (2006.01) |
| | H01M 50/434 | (2006.01) |

(52) U.S. Cl.

H01M 50/457 (2021.01); H01M 50/403 CPC (2021.01); H01M 50/417 (2021.01); H01M 50/489 (2021.01); H01M 10/4235 (2013.01); H01M 50/434 (2021.01)

(57)ABSTRACT

A multilayer porous membrane with two exterior layers and at least one interior layer. The average pore size of the interior layer is greater than that of either of the two exterior layers. The multilayer porous membrane may be used, for example, as or as part of a battery separator. Compared to prior multilayer porous membranes for battery separators, the multilayer porous membrane herein may exhibit at least one of improved thermal properties, improved anti-metal contamination properties, improved ease of manufacture, and combinations thereof.



☐ Upper ☐ Lower