



US009409814B2

(12) **United States Patent**
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(10) **Patent No.:** **US 9,409,814 B2**

(45) **Date of Patent:** ***Aug. 9, 2016**

(54) **CRYSTALLINE GLASS COMPOSITION AND ADHESIVE MATERIAL USING SAME**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/239,844**

(22) PCT Filed: **Aug. 13, 2012**

(86) PCT No.: **PCT/JP2012/070633**

§ 371 (c)(1),

(2), (4) Date: **Feb. 20, 2014**

(87) PCT Pub. No.: **WO2013/035500**

PCT Pub. Date: **Mar. 14, 2013**

(65) **Prior Publication Data**

US 2014/0221190 A1 Aug. 7, 2014

(30) **Foreign Application Priority Data**

Sep. 8, 2011 (JP) 2011-195588

(51) **Int. Cl.**

C03C 8/24 (2006.01)

C03C 8/02 (2006.01)

(Continued)

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

CPC . **C03C 8/04** (2013.01); **C03C 3/064** (2013.01);

C03C 3/066 (2013.01); **C03C 3/068** (2013.01);

C03C 8/02 (2013.01); **C03C 8/24** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC **C03C 8/02**; **C03C 8/04**; **C03C 8/24**;
H01M 8/0282

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,464,475 A * 8/1984 Beall et al. 501/9

5,242,722 A * 9/1993 Hiraka et al. 428/34.6

(Continued)

FOREIGN PATENT DOCUMENTS

CN 103987673 A 8/2014

JP 2002-362937 A 12/2002

(Continued)

OTHER PUBLICATIONS

English translation of Official Communication issued in corresponding International Application PCT/JP2012/070633, mailed on Mar. 20, 2014.

(Continued)

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(57) **ABSTRACT**

Provided is a crystallizable glass composition which exhibits a high coefficient of thermal expansion after undergoing thermal treatment, has excellent fluidity during the thermal treatment, and is less likely to deteriorate the hermeticity and adhesiveness at bonded portions and volatilize glass components even when exposed to high temperatures for a long period after the thermal treatment. A crystallizable glass composition capable of precipitating MgO-based crystals as main crystals by thermal treatment, the crystallizable glass composition containing, in terms of % by mole in glass component composition, 0.1 to 30% La₂O₃+Nb₂O₅+Y₂O₃+Ta₂O₅+Yb₂O₃.

8 Claims, 1 Drawing Sheet

