



Aalborg Universitet

AALBORG UNIVERSITY  
DENMARK

## Observation of Crack-Free Vickers Indents at 500 N in Annealed Caesium Aluminoborate Glass

Januchta, Kacper; Stepniewska, Malwina; Yue, Yuanzheng; Jensen, Lars Rosgaard; Zhang, Yang; Munch, Steffen S.; Somers, Marcel A. J.; Smedskjær, Morten Mattrup

*Publication date:*  
2019

[Link to publication from Aalborg University](#)

### *Citation for published version (APA):*

Januchta, K., Stepniewska, M., Yue, Y., Jensen, L. R., Zhang, Y., Munch, S. S., Somers, M. A. J., & Smedskjær, M. M. (2019). *Observation of Crack-Free Vickers Indents at 500 N in Annealed Caesium Aluminoborate Glass*. 137. Abstract from 25th International Congress on Glass, Boston, Massachusetts, United States.

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

### **Take down policy**

If you believe that this document breaches copyright please contact us at [vbn@aub.aau.dk](mailto:vbn@aub.aau.dk) providing details, and we will remove access to the work immediately and investigate your claim.

## **Observation of Crack-Free Vickers Indents at 500 N in Annealed Caesium Aluminoborate Glass**

K. Januchta\*<sup>1</sup> ; M. Stepniewska<sup>1</sup> ; Y. Yue<sup>1</sup> ; L. Jensen<sup>2</sup> ; Y. Zhang<sup>3</sup> ; S. Munch<sup>3</sup> ; M. Somers<sup>3</sup> ;  
M. M. Smedskjaer<sup>1</sup>

*1. Aalborg University, Department of Chemistry and Bioscience, Denmark 2. Aalborg University, Department of Materials and Production, Denmark 3. Technical University of Denmark, Department of Mechanical Engineering, Denmark*

Crack-resistant oxide glasses are increasingly important in modern day society due to the demand for materials that exhibit excellent mechanical performance, yet maintain transparency and acceptable chemical durability. This is currently achieved through post-processing, but such processes could cause undesirable side effects and/or additional cost. There is thus an interest in improving glass mechanics through composition optimization. In the search for crack-resistant glasses, i.e., glasses requiring high loads to initiate cracking during sharp contact loading, we have recently focused on aluminoborate glass compositions. Although this glass system suffers from poorer chemical durability and lower hardness compared to the industrially favored silicate-based compositions, their resistance to crack initiation is superior to that of the latter family. In this work, we present a caesium aluminoborate glass, which can withstand loads as high as ~500 N during Vickers indentation without forming any radial cracks. This exceeds the highest crack resistance previously reported for untreated, annealed oxide glasses by one order of magnitude. In addition, the created indents exhibit a time-dependent shrinkage, analogous to self-healing, which has never been reported to our knowledge. We discuss the origin of these observed behaviors in terms of a proposed molecular-scale deformation mechanism.