



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Chemical Durability and Crack Resistance of Alkali and Alkaline Earth Aluminoborate Glasses

Mascaraque Alvarez, Nerea; Januchta, Kacper; Frederiksen, Anne Kristine F.; Youngman, Randall E.; Bauchy, Mathieu; Smedskjær, Morten Mattrup

Publication date:
2017

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Mascaraque Alvarez, N., Januchta, K., Frederiksen, A. K. F., Youngman, R. E., Bauchy, M., & Smedskjær, M. (2017). *Chemical Durability and Crack Resistance of Alkali and Alkaline Earth Aluminoborate Glasses*. Poster presented at 9th International Conference on Borate Glasses, Crystals and Melts, Oxford, United Kingdom.

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 providing details, and we will remove access to the work immediately and investigate your claim.

Chemical Durability and Crack Resistance of Alkali and Alkaline Earth Aluminoborate Glasses

Nerea Mascaraque^{1,*}, Kacper Januchta¹, Anne Kristine Fledelius Frederiksen¹, Randall E. Youngman², Mathieu Bauchy³, Morten M. Smedskjaer¹

¹Department of Chemistry and Bioscience, Aalborg University, 9220 Aalborg, Denmark

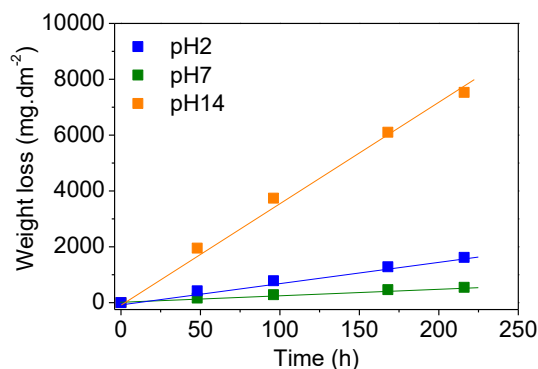
²Science and Technology Division, Corning Incorporated, Corning, USA

³Department of Civil and Environmental Engineering, University of California, Los Angeles, California 90095, USA

Poster

Abstract

Aluminoborate glasses have recently been found to exhibit favourable mechanical properties, especially high crack resistance. However, a fundamental understanding of the composition dependence of crack initiation and growth is still lacking. Moreover, the expected low chemical durability of these glasses could be a limiting factor for their potential applications. We therefore here study the dissolution kinetics and crack resistance of a wide range of aluminoborate compositions: (1) $25\text{Na}_2\text{O}-x\text{Al}_2\text{O}_3-(75-x)\text{B}_2\text{O}_3$ with $x=5, 10, 15, 20, 25, 27.5, 30$, (2) $25\text{MgO}-x\text{Al}_2\text{O}_3-(75-x)\text{B}_2\text{O}_3$ with $x=15, 20, 25, 30$, (3) $25(\text{M}_2\text{O or MO})-20\text{Al}_2\text{O}_3-55\text{B}_2\text{O}_3$ where M is Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, and (4) $(25-x)\text{Li}_2\text{O}-x\text{BaO}-20\text{Al}_2\text{O}_3-55\text{B}_2\text{O}_3$ with $x=0, 6.25, 12.5, 18.75, 20$ (all in mol%). The structure and properties of the samples are characterized through Nuclear Magnetic Resonance (NMR), Raman Spectroscopy, Differential Scanning Calorimetry (DSC), micro-indentation, aqueous durability test and Atomic Absorption Spectroscopy (AAS). We demonstrate and discuss how the crack resistance and chemical durability are affected by the local chemical environment in the glasses.



Brief Biographical Notes



Nerea Mascaraque is PostDoc in the Department of Chemistry and Bioscience at Aalborg University, Denmark. She graduated from Faculty of Chemistry at Universidad Autónoma de Madrid (Spain) in 2009 and received her PhD degree in materials chemistry from the same university and Ceramic and Glass Institute (ICV-CSIC) under the supervision of Dr. Francisco Munoz and Prof. Alicia Durán in 2014. Her PhD project was focused on glassy materials as solid electrolytes in all solid-state batteries (7 journal articles). Her current research focuses on atomistic design of chemically durable glasses under the supervision of Prof. Morten M. Smedskjaer (2 journal articles).