



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Enthalpy Relaxation and its Correlation to the Medium-Range Structural Evolution in a Hyperquenched SiO₂–Al₂O₃ System

Zhang, Y.F.; Zhao, D.H.; Yue, Yuanzheng

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Zhang, Y. F., Zhao, D. H., & Yue, Y. (2017). Enthalpy Relaxation and its Correlation to the Medium-Range Structural Evolution in a Hyperquenched SiO₂–Al₂O₃ System. Abstract from 12th Pacific Rim Conference on Ceramic and Glass Technology including Glass & Optical Materials Division Meeting 2017, Waikoloa, Hawaii, 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 providing details, and we will remove access to the work immediately and investigate your claim.

Enthalpy Relaxation and its Correlation to the Medium-Range Structural Evolution in a Hyperquenched SiO₂–Al₂O₃ System

Y. F. Zhang¹, D. H. Zhao², Y. Z. Yue^{1,3}

¹School of Materials Science and Engineering, Qilu University of Technology, Jinan 250353, China

²Unifrax I LLC, Tonawanda, NY 14150, USA

³Department of Chemistry and Bioscience, Aalborg University, 9220 Aalborg, Denmark

We study the sub- T_g enthalpy relaxation in an extremely unstable binary SiO₂–Al₂O₃ (SA) glass and its correlation to the change of the medium-range structure. The results show that the energy release peak for the hyperquenched SA glass over temperature is not symmetric, and a long tail is observed at the lower temperature starting from the onset temperature of the enthalpy release. With increasing annealing, the long tail gradually evolves into a peak and becomes broader. This phenomenon is quite different from that of many other hyperquenched glasses, in which the long tail gradually disappears with annealing. We find that the contents of both the 5- and 6-fold coordinated Al species in the hyperquenched SA glass decrease with annealing, while the 4-fold coordinated Al species increases. This leads to the formation of the oxygen triclusters which can act as the mullite nucleation sites. This is confirmed by the ordered structural domains at nano-scale as shown in the HRTEM images. The extremely unstable behavior of the studied glass against crystallization is attributed to both the higher content of the 5- fold coordinated Al and the easily formed oxygen triclusters in the hyperquenched glass during sub- T_g annealing. This work provides insights into both the structural evolution during relaxation and the structural heterogeneity of an unstable glass system.