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Chair	Dr. İlkay Sökmen

Structural Characterization of the Chemical Tempering Process of Soda-Lime Silicate Glasses

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Biography

Dr. Mattia Biesuz is an Assistant Professor of Materials Science and Technology at the University of Trento (Italy). He contributed to research in the field of non-conventional processing of ceramics and glasses, including field-assisted ion exchange. For his research in the field of firing, he was awarded the “Robert L. Coble Award for Young Scholars” (American Ceramic Society, US), “The MRS Postdoctoral Award” (Materials Research Society, US), and the “Pfeil Award” (IOM3 Institute of Materials Minerals & Mining, UK). Other research interests include chemical tempering, water-material interactions, high entropy ceramics, polymer-derived ceramics, and thermal energy storage. He authored 100+ manuscripts and serves as associate editor in Materials, Frontiers in Materials, and the Journal of the American Ceramic Society.

Abstract

Chemical tempering is a well-established and commonly used method for improving the mechanical properties of glasses. However, further research is still required to understand the structure and property relationships of the chemical tempered glasses.

In this study, chemically tempered glasses were characterized by positron annihilation spectroscopy technique to evaluate changes in network structure and get new information on the free volume evolution as a result of the K/Na ion exchange. The results reveal a modification of the free volume both in terms of density and amount. The change in the free volume size cannot be explained by a simple elastic model underscoring the activation of inelastic phenomena leading to stress relaxation. Furthermore, the trends in terms of free volume size are not monotonical and mimic the residual stresses evolution.

This work underscores for the first time experimentally the role of free volumes in the relaxation phenomena active during ion exchange.