Session	Materials Science in Glass (I)
Date	APRIL 10, 2025
Time (CET)	13:15 - 13:45
Chair	Dr. İlkay Sökmen

INVITED SPEAKER

Structural Design of a Scalable Glass with High Hardness and Crack Initiation Resistance

Prof. Dr. Ashutosh Goel

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Biography

Dr. Goel is a Professor in Materials Science and Engineering at Rutgers University, New Jersey, USA. Before joining Rutgers, Dr. Goel worked as a Materials Scientist at Pacific Northwest National Laboratory in Richland, WA, and Senior Research Scientist specializing in Optical Fibers at Sterlite Technologies Ltd. in Aurangabad, India.

Dr. Goel has authored or co-authored over 100 research articles in leading international journals and holds several U.S. patents. He serves as an Associate Editor for both the *Journal of the American Ceramic Society* and the *International Journal of Applied Glass Science*. He is also on the editorial board of the *Journal of Non-Crystalline Solids* and actively reviews for numerous scientific journals.

Additionally, Dr. Goel is actively involved in the International Commission on Glass (ICG) and the American Ceramic Society. He served as the Chair of the Technical Committee on Hazardous Waste Vitrification (TC05) from 2019-2025, and in the leadership committee of Bioceramics Division of the American Ceramic Society from 2018-2022. His impactful contributions to glass science and engineering have been recognized with prestigious honors, including the 2017 Vittorio Gottardi Prize (ICG), the 2021 W.H. Zachariasen Prize (*Journal of Non-Crystalline Solids*), and the 2023 Tadashi Kokubo Award (American Ceramic Society).

Abstract

The industry has long sought to develop glass that is both "hard" and "crack resistant." However, achieving these properties simultaneously in oxide glasses has proven to be exceptionally challenging. While Al_2O_3-rich oxide glasses with both hardness and crack resistance have been reported in recent years, their industrial application faces two major obstacles: (1) high processing temperatures exceeding 2000 ˚C and (2) limited glass-forming regions near the eutectic point. Our study introduces a structurally engineered high-modulus, hard and crack resistant glass designed within the peraluminous region of the $MgO–Al_2O_3–B_2O_3–SiO_2$ system containing rare earth oxides. This glass can be processed at temperatures ≤1650 ˚C, demonstrates a Vickers hardness (Hv) greater than 7 GPa (under a 1.96 N load), crack resistance (CR) of 26.5 N, and optical transmittance of 90 ± 2%. This presentation will explore the development process behind this glass, as well as ongoing efforts to address challenges related to its scale-up and commercialization.

Co-Authors

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