

83rd Conference on Glass Problems

Edited by
S.K. Sundaram

Ceramic
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Volume 271



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**83rd Conference
on Glass Problems**

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A Collection of Papers Presented at the
83rd Conference on Glass Problems

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Foreword

The 83rd Conference on Glass Problems (GPC) was organized by the Kazuo Inamori School of Engineering, The New York State College of Ceramics, Alfred University, Alfred, NY 14802, and The Glass Manufacturing Industry Council (GMIC), Westerville, OH 43082. The Program Director was S. K. Sundaram, Inamori Professor of Materials Science and Engineering, Kazuo Inamori School of Engineering, The New York State College of Ceramics, Alfred University, Alfred, NY 14802. The Conference Director was Bob Lipetz, Executive Director, GMIC, Westerville, OH 43082. The GPC Advisory Board (AB) included the Program Director, the Conference Director, and several industry representatives. The Board assembled the technical program. Donna Banks of the GMIC coordinated the events and provided support. It started with a full-day plenary session followed by technical sessions. The themes and chairs of four technical sessions were as follows:

Quality

Chris Tournour, Corning Incorporated, Corning, NY
Kenneth Bratton, Bucher Emhart Glass, Windsor, CT

Melting & Controls

Jim Uhlik, TECO, Toledo, OH
Shrikar Chakravarti, Linde Inc., Peachtree City, GA

Refractory & Raw Material

Erik Helin, Johns Manville, Windsor, CT
Eric Dirlam, SSOE Group, Toledo, OH

Combustion & Sustainability

Glenn Neff, Glass Service USA, Inc., Stuart, FL
Jan Schep – Owens-Illinois, Inc., Perrysburg, OH

Preface

This volume is a collection of papers presented at the 83rd year of the Glass Problems Conference (GPC) in 2022. The GPC continues the tradition of publishing the papers that goes back to 1934. The manuscripts included in this volume are reproduced as furnished by the presenting authors but were reviewed prior to the presentation and submission by the respective session chairs. These chairs are also the members of the GPC Advisory Board.

As the Program Director of the GPC, I am thankful to all the presenters at the 83rd GPC. This year's meeting was a winner on a positive trajectory of recovering and approaching pre-COVID 19 attendance level. We had a total of ~ 425 registered attendees including 10 students from across the country this year.

I truly appreciate all the support from the members of Advisory Board. Their volunteering spirit, generosity, professionalism, and commitment were critical to the high-quality technical program at this Conference. I am indebted to the outgoing Conference Director, Mr. Bob Lipetz, Executive Director of GMIC for his excellent unwavering leadership and support. I welcome Mr. Kerry Ward on board as new Conference Director and Executive Director of GMIC. I also appreciate continuing excellent support from Ms. Donna Banks of GMIC in organizing the GPC.

Please note that the American Ceramic Society and I edited and formatted these papers. Neither Alfred University nor GMIC is responsible for the statements and opinions expressed in this volume.

S. K. Sundaram
Alfred, NY
December 2022

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It is my great pleasure to acknowledge the dedicated service, advice, and team spirit of the members of the GPC AB in planning this Conference, inviting key speakers, reviewing technical presentations, chairing technical sessions, and reviewing manuscripts for this publication:

Kenneth Bratton – Bucher Emhart Glass, Windsor, CT
Jong Han – Owens Corning, Granville, OH
Shrikar Chakravarti – Linde Inc., Peachtree City, GA
Daniel Johnson – Libbey Glass, Toledo, OH
Eric Dirlam – SSOE Group, Toledo, OH
David Girvan – Vitro Architectural Glass, Cheswick, PA
Erik Helin – Johns Manville, Littleton, CO
Bob Lipetz – Glass Manufacturing Industry Council, Westerville, OH
Larry McCloskey – Anchor Acquisition, LLC, Lancaster, OH
Glenn Neff – Glass Service USA, Inc., Stuart, FL
Adam Polcyn – Vitro Architectural Glass, Cheswick, PA
Jan Schep – Owens-Illinois, Inc., Perrysburg, OH
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Phillip Tucker – Johns Manville, Littleton, CO
James Uhlik – Toledo Engineering Co., Inc., Toledo, OH
Justin Wang – Guardian Industries, Auburn Hills, MI
Kerry Ward – Glass Manufacturing Industry Council, Westerville, OH

I appreciate excellent leadership of Bob Lipetz, GMIC in making the GPC a big success this year. I am excited about an opportunity to work with Kerry Ward in supporting future GPCs. I am thankful to Donna Banks, GMIC for her patience, support, and attention to detail through the whole process.

PLENARY
