

82nd Conference on Glass Problems

Edited by
S.K. Sundaram

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on Glass Problems
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Edited by
S. K. Sundaram



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Foreword

The 82nd 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, Glass Manufacturing Industry Council (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. Despite continuing world-wide COVID-19 pandemic, the Conference was held face-to-face. It started with a full-day plenary session followed by technical sessions. The themes and chairs of four technical sessions were as follows:

Refractory

Larry McCloskey, Anchor Acquisition, LLC, Lancaster, OH
Eric Dirlam, Ardagh Glass, Muncie, IN

Data, Chemistry, Energy

Justin Wang, Guardian Industries, Auburn Hills, MI
Chris Tournour, Corning Incorporated, Corning, NY

Energy/Combustion

Glenn Neff, Glass Service USA, Inc., Stuart, FL
Uyi Iyoha, Linde Inc., Peachtree City, GA
Jan Schep – Owens-Illinois, Inc., Perrysburg, OH

Sensors/Energy

Glenn Neff, Glass Service USA, Inc., Stuart, FL

Preface

This volume is a collection of papers presented at the 82nd year of the Glass Problems Conference (GPC) in 2021. 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 82nd GPC. This year's meeting was another record-breaking year under the extraordinary situation. We had a total of 357 registered attendees including 6 students from across the country. I appreciate all the support from the members of Advisory Board. Their volunteering spirit, generosity, professionalism, and commitment through an unprecedented world-wide pandemic were critical to the high-quality technical program at this Conference. The Conference Director, Mr. Bob Lipetz, Executive Director of GMIC forged ahead with strong leadership against all odds and worked tirelessly with the Advisory Board in making this Conference a success. I also appreciate continuing excellent support from Ms. Donna Banks of GMIC in organizing the GPC. I look forward to continuing our work with the entire GPC team in the future.

Please note that The American Ceramic Society and I did minor editing and formatting of these papers. Neither Alfred University nor GMIC is responsible for the statements and opinions expressed in this volume.

S. K. Sundaram
Alfred, NY
January 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:

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Weijian Chen – *Libbey Glass, Toledo, OH*
Eric Dirlam – *Ardagh Glass, Muncie, IN*
David Girvan – *Vitro Architectural Glass, Cheswick, PA*
Erik Helin – *Johns Manville, Littleton, CO*
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Bob Lipetz – *Glass Manufacturing Industry Council, Westerville, OH*
Larry McCloskey – *Anchor Acquisition, LLC, Lancaster, OH*
Glenn Neff – *Glass Service USA, Inc., Stuart, FL*
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Jan Schep – *Owens-Illinois, Inc., Perrysburg, OH*
Christopher Tournour – *Corning Incorporated, Corning, NY*
Phillip Tucker – *Johns Manville, Littleton, CO*
James Uhlik – *Toledo Engineering Co., Inc., Toledo, OH*
Justin Wang – *Guardian Industries, Auburn Hills, MI*

I appreciate the positive spirit of Bob Lipetz, GMIC with which he has led the GPC to a success this year. I am indebted to Donna Banks, GMIC for her patience, support, and attention to detail in making this conference a big success and this Proceedings possible.

Finally, the whole team has worked tirelessly against all odds of the ongoing world-wide pandemic making this a successful face-to-face conference. The determination and enthusiasm are simply outstanding.

PLENARY



THE UNITED NATIONS INTERNATIONAL YEAR OF GLASS-2022

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ABSTRACT

On May 18, 2021 the United Nations General Assembly formally approved a resolution declaring the year 2022 “The International Year of Glass”. This is a seminal and celebratory moment for the global glass community. It is noteworthy that this is the first time that United Nations has accorded such a recognition to a specific material and represents an acknowledgment of the vital role glass has played and will continue to play in the advancement of human society. The UN resolution was the culmination of enormous efforts of many individuals and organizations from all over the world under the leadership of the International Glass Commission (ICG) president, Alicia Duran. The vision for the International Year of Glass originated with L. David Pye (ICG president, 1997-2000) in 2018. Under the chief editorship of Pye, the International Journal of Applied Glass Science published special issues on the themes of “Glass and Light” (to mark the 2015 UN International Year of Light and Light-based Technologies), and “Glass Age”. This was followed by a series of presentations at several international forums during 2016-2018 by the then ICG President Manoj K. Choudhary and David Pye and to promote and rally support for the theme of “Glass Age”. This paper provides background information on the UN resolution and discusses the scientific, technological, and economic significance of glass, a vitally important material for meeting the challenges of climate change and developing equitable and sustainable society. Also highlighted is the role glass has played in arts and advancing human civilization throughout the history and concludes with an outline of various events planned around the world to celebrate the year 2022 as the International Year of Glass.

INTRODUCTION

In this paper we describe the rationale, the history, and the massive international effort undertaken to have the United Nations General Assembly (UNGA) approve the resolution to declare the year 2022 as the “International Year of Glass”. We also describe the goals and the plans for celebration of all things glass in 2022.

Since 1959 the United Nations has declared several International Years to focus on particular topics, themes, or events. Usually it is one or more member states that propose these observances and the UN General Assembly (UNGA) establishes them by passing a resolution. The year 2015, for example, was the International Year of Light / Light-based Technologies. The International Journal of Applied Glass Science (IJAGS) marked this event by having a special issue devoted to the theme “Light and Glass” (Part I in September 2015, Part II in December 2015). There have been other UN International Years devoted to scientific themes (e.g., Physics -2015, Chemistry – 2011, Crystallography – 2014, and Periodic Table – 2019). The International Year of Glass in 2022 is the first such recognition accorded by UN to a material and represents an acknowledgment by the UN of the vital role glass has played and will continue to play in the

advancement of human society. The global glass community should justifiably be proud of this honor.

GENESIS AND HISTORY OF THE INTERNATIONAL YEAR OF GLASS

The genesis for holding a UN sponsored International Year of Glass goes back to 2014 when Corning proposed the term “Arrival of Glass Age” to highlight the critical importance of glass in our lives. The same year, when David Pye learned that the UN General Assembly would declare 2015 an International Year of Light and Light-based Technologies he, as the then editor-in-chief of IJAGS, arranged for the publication, as mentioned earlier” of a special issue “Glass and Light”. The theme of “Glass Age” was also highlighted in a special issue of IJAGS (Part I in December 2016, and Part II in March 2017). Concurrently and extending into 2018, lectures by Manoj Choudhary and David Pye to international audiences explored the theme that glass science, engineering, and art were entering new and profound chapters in their histories. Those lectures sought to rally the global glass community behind the premise of “Glass Age”. It is an interesting and important coincidence that, in 2018, the Atlantic Monthly published an article by Douglas Main¹ in which he called glass “humankind’s most important material”, and noted that “without glass, the world would be unrecognizable”.

Next, and also in 2018, David Pye floated the concept of an International Year of Glass (IYOG) with Charles Craig, Senior Vice President, Science and Technology, Corning Inc. Craig was strongly supportive and was joined soon after by Choudhary, who with Pye tabled a motion at an ICG Council meeting in Japan:

“The International Commission on Glass, representing organizations and individuals throughout the world dedicated to the promotion of science, technology, artistry, and application of glass enthusiastically endorses the exploration of a future declaration of a Year of Glass by the United Nations.”

Following this positive reception, Pye presented the concept to the American Ceramic Society Board (ACerS) and the Corning Museum of Glass (CMoG). Both embraced the idea and Steve Gibbs, a senior administrator at CMoG, played a pivotal role in advancing the idea to the international art community. The ICG, at its triennial Congress, held in Boston in 2019, formally agreed to pursue the declaration of the UN International Year of Glass in 2022 (IYOG22) under the leadership of president Duran. Spain’s ambassador to UN, Honorable Agustín Santos Maraver agreed to lead the effort in UN. IYOG2022 also received endorsements from the Community of Glass Associations, and International Committee for Museums and Collection of Glass. The die was cast.

RATIONALE FOR 2022

The year 2022 was chosen because, as shown below, it coincides with several key anniversaries pertaining to glass.

- **670th** : Earliest depiction of eyeglasses in a painting (frescoes of Tommaso da Modena in Treviso, Italy, 1352)
- **200th** : Invention of Fresnel Glass Lens (used in seashore lighthouses; have prevented countless disasters)
- **100th** : Discovery of ancient Egyptian Glass in King Tutankhamun’s Tomb
- **100th** : Founding of the German Society of Technology (DGG)