67th Conference on Glass Problems
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A Collection of Papers Presented at the 67th Conference on Glass Problems, The Ohio State University, Columbus, Ohio, October 31–November 1, 2006

Editor
Charles H. Drummond, III

The American Ceramic Society

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Foreword

The 67th Conference on Glass Problems was sponsored by the Departments of Materials Science and Engineering at The Ohio State University.

The director of the conference was Charles H. Drummond, III, Associate Professor, Department of Materials Science and Engineering, The Ohio State University.

Dean William A. Baeslack, College of Engineering, The Ohio State University, gave the welcoming address. Former Chairman John Morral, Department of Materials Science and Engineering, The Ohio State University, gave the Departmental welcome.

The themes and chairs of the five half-day sessions were as follows:

**The Future of the Glass Industry**
Gerald DiGiampaolo, PPG Industries, Pittsburgh PA
John Tracey, North American Refractories, Cincinnati OH

**Safety**
Terry Berg, CertainTeed, Athens GA
Larry McCloskey, Toledo Engineering, Toledo OH

**Modeling**
Ruud Beerkens, TNO Glass Technology – Glass Group, Eindhoven, The Netherlands
Elmer Sperry, Libbey Glass, Toledo OH
Environment
Tom Dankert, Owens-Illinois, Toledo OH
Dick Bennett, Johns Manville, Littleton CO

Energy
Bob Thomas, Corning, Corning NY
Sho Kobayashi, Praxair, Danbury CT

Melting and Refractories
C. Philip Ross, Glass Industry Consulting, Laguna Niguel CA
Dave Watters, Osram Sylvania, Exeter NH
In the tradition of previous conferences, started in 1934 at the University of Illinois, the papers presented at the 67th Annual Conference on Glass Problems have been collected and published as the 2006 edition of The Collected Papers.

The manuscripts are reproduced as furnished by the authors, but were reviewed prior to presentation by the respective session chairs. Their assistance is greatly appreciated. The Ohio State University is not responsible for the statements and opinions expressed in this publication.

CHARLES H. DRUMMOND, III
The Ohio State University
Columbus, OH
It is a pleasure to acknowledge the assistance and advice provided by the members of Program Advisory Committee in reviewing the presentations and the planning of the program:

Ruud G. C. Beerkens—TNO-TPD
Dick Bennett—Johns Manville
Terry Berg—CertainTeed
Tom Dankert—Owens-Illinois
Gerald DiGiampaolo—PPG Industries
H. "Sho" Kobayashi—Praxair
Larry McCloskey—Toledo Engineering
C. Philip Ross—Glass Industry Consulting
Elmer Sperry—Libbey Glass
Robert Thomas—Corning
John Tracey—North American Refractories
David A. Watters—Osram Sylvania
MARKET TRENDS
CONTAINER GLASS UPDATE

Rick Bayer
Glass Packaging Institute

ABSTRACT

The Glass Packaging Institute (GPI) is the trade association representing the North American glass container industry. Through GPI, glass container manufacturers speak with one voice to advocate industry standards, promote sound environmental policies and educate packaging professionals. GPI member companies manufacture glass containers for food, beverage, cosmetic and many other products. GPI also has associate members that represent a broad range of suppliers.

GLASS CONTAINER MARKET

![Glass Container Markets by End Use 2005](image)
Container Glass Update

Glass Container Market Share 2005
(U.S.)

- Owens-Illinois: 43%
- Saint-Gobain Containers: 33%
- Anchor Glass: 18%
- Others: 8%

Source: Punktell estimate

49 U.S. Glass Container Manufacturing Plants

<table>
<thead>
<tr>
<th>State</th>
<th># Per State</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>5</td>
</tr>
<tr>
<td>Indiana, Pennsylvania</td>
<td>4</td>
</tr>
<tr>
<td>Georgia, Illinois, New Jersey, North Carolina, Oklahoma, Texas</td>
<td>3</td>
</tr>
<tr>
<td>Colorado, Missouri, New York, Virginia</td>
<td>2</td>
</tr>
<tr>
<td>Arkansas, Florida, Louisiana, Massachusetts, Michigan, Minnesota, Ohio, Oregon, Washington, Wisconsin</td>
<td>1</td>
</tr>
</tbody>
</table>
Glass Container Manufacturing
2000-2005

Global Glass Use By Category
• Container Glass – 51%
• Flat Glass – 31%
• Other (Fiberglass, Tableware, Specialty) – 18%

ENVIRONMENT AND ENERGY

Environmental Activities

- OZONE Transport Commission
  - Requesting dramatic reductions in NOx
- California Greenhouse Gas Emissions Law
  - Goal of reducing all components back to 1990 levels
- EPA Continues Heavy Enforcement Activity
  - Permitting pressure versus compliance
  - Capital and operating costs of abatement solutions
  - Increasing complexity of reporting and recordkeeping requirements

Energy Issues for Containers

- Increased energy costs
- Effect on industry margins worldwide
- No major relief envisioned at this time