Advances in Porcelain Enamel Technology

Ceramic Transactions, Volume 211


Conference Director
Peter Vodak

Assistant Conference Director
Mike Horton

Chief Editor
Charles Baldwin

Assistant Editors
2008—Holger Evele
2009—Renee Pershinsky

The American Ceramic Society

A John Wiley & Sons, Inc., Publication
This Page Intentionally Left Blank
Advances in Porcelain Enamel Technology
Advances in Porcelain Enamel Technology

Ceramic Transactions, Volume 211


Conference Director
Peter Vodak

Assistant Conference Director
Mike Horton

Chief Editor
Charles Baldwin

Assistant Editors
2008—Holger Evele
2009—Renee Pershinsky

The American Ceramic Society

WILEY

A John Wiley & Sons, Inc., Publication
Contents

Preface ix
2008 PEI Officers xi
2009 PEI Officers xii
2008 Technical Forum Committee xiii
2009 Technical Forum Committee xiv
Past Chairs of PEI Technical Forums xv

2008 PEI Tech Forum

Dense Phase Pumping and Spraying of P/E Powder
Ken Kreeger 3

Development of the Cold Roll RP45 Grade for Water Heater
Tank Bodies
Stan Lipkowski 9

Energy Cost in Washer Systems
Brian Rozdilsky 15

Comparison of Cobalt and Nickel in Frit Formulations
Mike Wilczynski and Roger Wallace 17

Raw Materials and Energy: Influence on Enamels Market
Bruce Hanna 23

LustReflex Coatings for Porcelain Enamel
E.A. Axtel III and Klaus-Dieter Fritsche 29
The PEI Technical Forum Committee is pleased to provide you with the combined proceedings of the 70th and 71st Annual PEI Technical Forum. This volume is the culmination of the efforts of the committee, who spent much time preparing for the two conferences. Both were held at the Double Tree Downtown Hotel with the 2008 Forum from June 9th–12th, 2008 and the 2009 Forum from May 4th–7th, 2009. As you receive these proceedings, work is already underway on the 72nd Annual PEI Technical Forum, to be held in Nashville in May of 2010 and the upcoming International Enamellers Congress to be held in Chicago, tentatively in 2012.

First, I would like to thank everyone who attended the two conferences, and, in particular, those who participated by giving talks. I would also like to thank the members of the Technical Forum Planning Committee for planning and successfully executing these two conferences. We have all lived through stresses, strains, and sacrifices of the recent Great Recession. Our businesses are demanding more and more of less and less of us than ever. It is more difficult to get travel approved, hard to be away from the office and family, and it is more difficult to find the time outside normal business hours to do the work above and beyond required for an endeavor like the PEI. As such, everyone's extra effort is appreciated more than ever.

The PEI and the associated Back-to-Basics seminar have significantly educational and training value. Decades of experience and many viewpoints are brought together, and it is a unique opportunity to meet with multiple customers at once. The PEI Technical Forum is provides invaluable information and training to the industry for people of all knowledge levels. Marketers and design engineers worldwide learn of enamel and how to best put it to use as a low cost environmentally friendly finish capable for lasting for centuries. We need to continue fulfilling that purpose while training people new to the industry so it can be guaranteed a prosperous future.

This proceedings volume is dedicated to the memory of Dana Chase, Bob Long, Tony Mazuca, John Oliver, and Charlie Summers who all passed away during 2009.

CHARLES BALDWIN
Ferro Corporation
2008–2009 Tech Forum Proceedings Chief Editor
This Page Intentionally Left Blank
2008 PEI Officers

Chairman of the Board
BOB HARRIS
Hanson Industries, Inc.

President
WILLIAM GANZER
Mapes and Sprowl Steel

Vice Presidents
CHUCK DOCKERY
Briggs Industries
MIKE HORTON
KMI Systems, Inc.
BILL MACDONALD
P G Bell, Inc.
NORM NAPIER
Shepherd Color Company
WARREN NORTON
Dofasco Steel
PETER VODAK
Engineered Storage Products
JEFF WRIGHT
Ferro Corporation

Executive Committee Members
JONATHAN DAVIES
Pemco Corporation
PETER DORITY
Coral Chemical Company
KEN KREEGER
Nordson Corporation
DON MCCORMICK
Electrolux Home Products
GLENN PFENDT
A. O. Smith Corporation
NICK SEDALIA
Whirlpool Corporation

Treasurer
KEVIN COURSIN
KMI Systems, Inc.

Executive Vice President
CULLEN HACKLER
PEI
2009 PEI Officers

Chairman of the Board
WILLIAM GANZER
Mapes and Sprowl Steel

President
JEFF WRIGHT
Ferro Corporation

Vice Presidents
BOB ANDERSON
EIC Group North America
PETER DORITY
Coral Chemical Company
KIM FREY
S & S Porcelain
LIAM O'BYRNE
HKF Industries
GLENN PFENDT
A O Smith Corporation
BRYAN STOCKDALE
WinsorFireform
DEBRA VOGES
Roesch, Inc.

Executive Committee Members
KEVIN COURSIN
KMI Systems, Inc.
JONATHAN DAVIES
Pemco Corporation
BOB HARRIS
Hanson Industries, Inc.
KEN KREEGER
Nordson Corporation
TIM SCOTT
Henkel Surface Technologies
NICK SEDALIA
Whirlpool Corporation

Treasurer
PHIL FLASHER
ITW Gema

Executive Vice President
CULLEN HACKLER
PEI

Porcelain Enamel Institute
PO Box 920220, Norcross, GA 30010
Phone: 770-281-8980
E-mail: penamel@aol.com
www.buyporcelain.org / www.porcelainenamel.com
2008 Technical Forum Committee

Chairman: Peter Vodak (Engineered Storage Products)
Vice Chairman: Mike Horton (KMI Systems, Inc.)

Peter Dority (Coral Chemical Company)
Holger Evele (Ferro Corporation)
Cullen Hackler (PEI)
Ken Kreeger (Nordson Corporation)
Tony Mazzuca (Pemco Corporation)
Liam O’Byrne (HKF Industries, Inc.)
Pat Pawlicki (Pemco Corporation)
Tim Scott (Henkel Surface Technologies)
Larry Steele (Mapes and Sprowl Steel)
Dave Thomas (American Trim)
Miles Votava, (Ferro Corporation)
Jack Waggener (URS Corporation)
Mike Wilczynski (AO Smith Corporation)
Ted Wolowicz (Electrolux Home Products)
Jeff Wright (Ferro Corporation)
2009 Technical Forum Committee

Chairman: Peter Vodak (Engineered Storage Products)
Vice Chairman: Mike Horton (KMI Systems, Inc.)

Jason Butz (Engineered Storage Products)
Jeff Dailidas (Nordson Corporation)
Peter Dority (Coral Chemical Company)
Holger Evele (Ferro Corporation)
Phil Flasher (ITW Gema)
Cullen Hackler (Porcelain Enamel Institute)
Mike Koenigstein (Roesch, Inc.)
Kara Kopplin (QTEC Consulting)
Ken Kreeger (Nordson Corporation)
David Latimer (Whirlpool Corporation)
Tony Mazzauc (Pemco Corporation)
Warren Norton (Arcelor Mittal Steel)
Liam O’Byrne (O’Byrne Consulting Services)
Tim Scott (Henkel Surface Technologies)
Lester Smith (Porcelain Consultants)
Larry Steele (Mapes & Sprowl Steel)
Jim Terwilliger (A O Smith Water Heaters)
Dave Thomas (American Trim)
Miles Votava (Ferro Corporation)
Jack Waggner (URS Corporation)
Mike Wilczynski (A O Smith Protective Coatings)
Ted Wolowicz (Electrolux Home Products)
Jeff Wright (Ferro Corporation)
Past Chairs of PEI
Technical Forums

Holger Evele 2006–07
  Ferro Corporation
Steve Kilczewski 2004–05
  Pemco Corporation
Liam O’Byrne 2002–03
  AB&I Foundry
Jeff Sellins 2000–01
  Maytag Cooking Products
Robert Reese 1998–99
  Frigidaire Home Products
David Thomas 1996–97
  The Erie Ceramic Arts Company
Rusty Rarey 1994–95
  LTV Steel Company
Douglas Giese 1992–93
  GE Appliances
Anthony Mazzuca 1990–91
  Mobay Corporation
William McClure 1988–89
  Magic Chef
Larry Steele 1986–87
  Armco Steel
Donald Sauder 1984–85
  WCI–Range Division
James Quigley 1982–83
  Ferro Corporation
George Hughes 1980–81
  Vitreous Steel Products Company
Lester Smith 1978–79
  Porcelain Metals Corporation
Evan Oliver 1977  
_Bethlehem Steel Corporation_

Wayne Gasper 1975–76  
_The Maytag Company_

Donald Toland 1973–74  
_U.S. Steel Corporation_

Archie Farr 1971–72  
_O. Hommel Company_

Harold Wilson 1969–70  
_Vitreous Steel Products Company_

Forrest Nelson 1967–68  
_A.O. Smith Corporation_

Grant Miller 1965–66  
_Ferro Corporation_

Mel Gibbs 1963–64  
_Inland Steel Company_

Charles Kleinhans 1961–62  
_Porcelain Metals Corporation_

James Willis 1959–60  
_Pemco Corporation_

Lewis Farrow 1957–58  
_Whippool Corporation_

Gene Howe 1955–56  
_Chicago Vitreous Corporation_

W.H. “Red” Pfieffer 1953–54  
_Frigidaire Division, G.M.C._

Roger Fellows 1951–52  
_Chicago Vitreous Corporation_

Glenn McIntyre 1948–50  
_Ferro Corporation_

Frank Hodek 1936–47  
_General Porcelain Enameling and Mfg. Company_
This Page Intentionally Left Blank
DENSE PHASE PUMPING AND SPRAYING OF P/E POWDER

Ken Kreeger
Nordson Corporation

The presentation will review the development, advantages and use of dense phase pumping and spraying of powder porcelain enamel.

A review of the development, advantages and use of dense phase pumping and spraying of porcelain enamel powder.

Traditional system with booth, recovery system, delivery system and guns.

How much lost production (profit on goods) is lost during downtime?

With faster color change and greater transfer efficiency, new “lean” non-reclaim systems are becoming popular.