SELECTED TECHNICAL PAPERS

STP1588

Editors: Robert A. Wessel, Paul H. Shipp, Guy L. Rosenthal

Advances in Gypsum Technologies and Building Systems

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Foreword

THIS COMPILATION OF Selected Technical Papers, STP1588, Advances in Gypsum Technologies and Building Systems, contains peer-reviewed papers presented at a symposium held May 21, 2015, in Anaheim, CA. The symposium was sponsored by ASTM International Committee C11 on Gypsum and Related Building Materials and Systems and Subcommittee C11.01 on Specifications and Test Methods for Gypsum Products.

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Overview

C11: A Celebration of a Century of Service

This year, 2015, ASTM Committee C11 on Gypsum and Related Building Materials and Systems celebrates 100 years of service and standardization. Through a century marked by significant growth and development, punctuated by economic downturns, recessions, and the great depression, plus a number of wars and domestic upheaval, Committee C11 met and functioned continuously.

Surviving committee documents, mostly annual reports of the committee, give us the names and enable the recognition of those who have served as main committee officers and subcommittee chairmen, along with those who have been honored with various committee and society awards across the decades. Although many of these named individuals occupied leadership positions and others received public recognition of exemplary service, a committee is more than just its leaders and award recipients. It should always be remembered that the work, contributions, and participation of those whose names have been lost performed valuable services along the way to move the committee and its documents forward.

Committee C11: Officers, Subcommittees, and Membership

The first annual report filed by Committee C11 on Standard Specifications for Gypsum and Gypsum Products appeared in the 1915 ASTM book of annual committee reports. At that time, the Committee consisted of 22 members and five subcommittees.

The 1916 annual report lists a total of 30 members and the 1917 report identifies the committee as “Committee C-11 on Gypsum.” The name of the committee was changed again in 1973 to the committee “on Ceilings and Walls.” In either 1979 or 1980 (there was no annual report filed in 1979) the committee was redesignated as Committee C11 “on Gypsum and Related Building Materials and Systems,” the current name for the committee.

The number of active subcommittees has hovered steadily between five and seven as the committee scope was expanded from gypsum and gypsum plaster to include associated products such as studs and accessories, and most recently, Exterior Insulation and Finishing Systems (EIFS). The membership has grown each year from the original 22 members to over 360 members today.
The founding officers, members, and subcommittees listed in the 1915 annual report were:

**Committee Officers**
R. J. Wig, Chairman
H. W. Forster, Vice-Chairman
V. G. Marani, Vice-Chairman
L. I. Neale, Secretary

**Members—Non-Producers**
Abrams, D. A.
Emley, W. E.
Forster, H. W. (*Vice-Chairman*)
Froehling and Robertson
Froehling, H.
Handy, J. O.
MacGregor, J. S.
Miller, R. P.
Norton, C. L.
Pittsburg Testing Laboratory
Riddle, C. W.
Slater, W. A.
Underwriters' Laboratories
Waid, D. E.
Wig, R. J. (*Chairman*)

**Members—Producers**
American Cement Plaster Company
Apted, A. H.
Brown, H. J.
Grand Rapids Plaster Company
Gypsum Industries Association Inc.
Haigh, De Lagnel
Jewett, M. B.
Marani, V. G. (*Vice-Chairman*)
Neale, L. I. (*Secretary*)
Southard, G. L.
Southern Gypsum Company
Tupper, E.
United States Gypsum Company
Webb, S. G.
Wilder, F. A.
The Committee was made up of the following five subcommittees:

Subcommittee I on Gypsum for Various Uses, chaired by H. J. Brown
Subcommittee II on Gypsum Plasters, chaired by De Lagnel Haigh
Subcommittee III on Structural Gypsum Products, chaired by W. A. Slater
Subcommittee IV on Testing Methods, chaired by W. E. Emley
Subcommittee V on Nomenclature, chaired by S. G. Webb

The original officers of the committee consisted of the chairman, two vice-chairmen, and a secretary. The number of vice-chairmen was reduced to one in 1938. By 2010 the number of new member applications, which were managed and processed by the secretary, was deemed to be sufficient to justify the creation of a new officer position in the form of a membership secretary. Over the 100-year life of the committee, the following individuals served as main committee officers in the offices indicated:

**Chairmen**

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<td>1915–1919</td>
<td>R. J. Wig</td>
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<tr>
<td>1919–1926</td>
<td>W. E. Emley</td>
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<tr>
<td>1926–1937</td>
<td>J. W. Ginder</td>
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<td>1937–1953</td>
<td>L. S. Wells</td>
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<td>1953–1964</td>
<td>G. W. Josephson</td>
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<tr>
<td>1964–1968</td>
<td>Max Barth</td>
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<tr>
<td>1968–1972</td>
<td>G. W. Josephson</td>
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<tr>
<td>1972–1979</td>
<td>Richard A. Kuntze</td>
</tr>
<tr>
<td>1979–1980</td>
<td>C. E. Kallem</td>
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<tr>
<td>1992–1994</td>
<td>George W. Green</td>
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<td>1994–1995</td>
<td>James L. Houser</td>
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<td>1996–2001</td>
<td>Dick C. Engbrecht</td>
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<td>2002–2007</td>
<td>Keith A. Poerschke</td>
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<tr>
<td>2008–2013</td>
<td>Michael C. Kerner</td>
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<td>2014–</td>
<td>Pamela Shinkoda</td>
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**Vice-Chairmen**

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<tr>
<th>Period</th>
<th>Name</th>
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<tr>
<td>1915–1916</td>
<td>H. W. Forster &amp; V. G. Marani</td>
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<td>1916–1926</td>
<td>F. A. Wilder &amp; R. P. Miller</td>
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<tr>
<td>1926–1931</td>
<td>H. E. Brookby &amp; R. P. Miller</td>
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<td>1936–1938</td>
<td>H. J. Brown &amp; L. S. Wells</td>
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<tr>
<td>1938–1943</td>
<td>H. J. Brown</td>
</tr>
<tr>
<td>1943–1944</td>
<td>vacant</td>
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1944–1954  H. F. Gardner
1954–1961  B. W. Nies
1961–1967  G. B. Kirk
1967–1971  Rex L. Selbe
1971–1976  John D. Shull
1979–1980  John D. Shull
1980–1982  H. T. Schneiter
1982–1990  George W. Green
1990–1995  Dick C. Engbrecht
1996–1998  James L. Houser
1998–2001  Keith A. Poerschke
2002–2007  Michael C. Kerner
2008–2013  Pamela Shinkoda
2014–      Michael Logue

Secretaries
1915–1918  L. I. Neale
1918–1926  V. G. Marani
1926–1947  Henry J. Schweim
1947–1948  Lloyd H. Yeager
1948–1950  Chester E. Abby
1950–1954  Lloyd H. Yeager
1958–1960  R. H. Faber
1960–1970  Henry Omson
1970–1971  David E. Brackett
1971–1979  Herb B. Carlsen
1979–1987  David E. Brackett
1987–2013  Robert A. Wessel
2014–      Richard Ladwig

Membership Secretaries
2010–2013  Richard Ladwig
2014–      Ben Duterte

Nothing remains static forever and, over time, the committee passed through a number of iterations as it evolved through several name changes and expansions in its scope. The subcommittee structure also went through a number of changes as subcommittees were created, deactivated, redesignated, combined, and renamed to fit the needs of the evolving scopes, membership, and interests.

The following individuals served as chairmen of the subcommittees under which they are listed. The year in which the individual took office is given and that person
served continuously until the year in which the next individual in the list took office. Subcommittees I-V were formed in 1915 and Subcommittee VI was formed in 1922. These subcommittees operated until the subcommittee structure was changed in 1950.

Subcommittee I on Gypsum for Various Uses
1915    H. J. Brown
1918    F. A. Wilder
1930    H. E. Brookby
1931    H. J. Brown

Subcommittee II on Gypsum Plasters
1915    De Lagnel Haigh
1926    J. Miller Porter
1941    D. D. Crandell
1942    G. W. Farrell
1948    H. F. Gardner

Subcommittee III on Structural Gypsum Products
1915    W. A. Slater
1922    L. I. Neale
1923    Fitzhugh Taylor
1926    H. W. Reel
1932    L. S. Wells
1947    N. D. Mitchell

Subcommittee IV on Testing Methods
1915    W. E. Emley
1919    G. L. Southard
1920    H. E. Brookby
1926    H. F. Gardner
1928    H. E. Brookby
1930    C. K. Roos
1943    H. N. Huntzicker

Subcommittee V on Nomenclature
1915    S. G. Webb
1918    Vacant
1919    A. H. Apted
1923    L. I. Neale
1925    subcommittee disbanded
Subcommittee VI on Fire Resisting Properties of Gypsum Products, Created 1922
1922    S. H. Ingberg
1925    subcommittee disbanded

The 1950 reorganization reduced the number of subcommittees from six to two; one on Plasters and the other on Structural Products. A third subcommittee, on Aggregates, was added in 1955 and a fourth, on Research, was added in 1967. Those subcommittees and their chairmen are listed below:

Subcommittee I on Plasters
1950    H. N. Huntzicker
1954    B. W. Nies
1961    C. G. Shuttleworth
1966    J. D. Shull
1969    R. L. Selbe

Subcommittee II on Structural Products
1950    N. D. Mitchell
1952    F. L. Marsh
1954    R. G. Buergin
1962    H. R. Nelson
1965    vacant
1966    Clarion Kallam

Subcommittee III on Aggregates, Created 1955
1955    Stanton Walker
1957    E. T. Carlson
1969    vacant

Subcommittee IV on Research, Formed in 1967
1967    P. J. Sereda

The most recent major restructuring of the subcommittees took place in 1972 and, with a few minor tweaks, is essentially the same as the subcommittee structure used today. In 1976, Subcommittee .04 was redesignated as .91 and given a new name. A new Subcommittee .04 was created in 1985 to develop specifications on synthetic gypsum and Subcommittee .05 on Application of EIFS was added in 1990. The subcommittees and their chairman are listed below:

Subcommittee .01 on Specifications and Test Methods for Gypsum Products
1972    H. L. Weightman
1980    V. H. Noble
1981    E. J. Salamon
1982  D. O. Baehr
1990  George Shortreed
2006  Brad Wing
2007  Dick C. Engbrecht
2013  Keith A. Poerschke

Subcommittee .02 on Specifications and Test Methods for Accessories and Related Products
1972  J. E. Gillespie
1980  R. N. Parker
1991  M. C. Kerner
2010  J. R. Smith
2014  M. C. Kerner

Subcommittee .03 on Specifications for the Application of Gypsum and Other Products in Assemblies
1972  G. Erwin
1980  R. N. Gulick
1990  J. W. Fell
1994  A. Eugene Erwin
1997  Michael Gardner
1999  vacant
2001  Lee G. Jones
2006  Michael Logue
2008  Don Smith
2013  Lee G. Jones

Subcommittee .04 on Research, Redesignated in 1976 as Subcommittee .91
1972  G. W. Green

1985  J. W. Pressler
1991  R. W. Styron
1994  John R. Glasscock

Subcommittee .05 on Application of Exterior Insulating and Finish Systems and Related Products, Organized in 1990
1990  R. G. Reitter III
1992  J. D. Hopkins, Jr.
1998  Frank E. Nunes
2001  John L. Mulder
2006  Peter B. Harrison
Subcommittee .91 on Nomenclature, Definitions and Research, Organized in 1976 to Replace Subcommittee .04 and Renamed as the Subcommittee “on Terminology and Editorial” in 1993
1976   G. W. Green
1993   David E. Brackett
1995   Robert A. Wessel
2013   Robert Mercer
2014   Darin Coats

Subcommittee .92 on Editorial, Organized in 1976 and Disbanded and Combined with .91 in 1993
1976   L. Katz
1980   R. O. Kidd
1991   David E. Brackett

The companies and organizations represented by these individuals are largely unknown. A few of the earlier documents consulted in the compiling of this list included company names when the individual was serving as a representative of a corporate member. Some individuals changed employment one or more times during their membership so any attempt to compile a comprehensive list of companies would be prohibitive and, most likely, also be either incomplete or incorrect.

Committee C11: Awards and Their Recipients

In addition to the subcommittee chairmen, a large number of individuals served as secretaries to the subcommittees and, no doubt, as task group chairmen. The names of these individuals seldom get recorded outside of the minutes, most of which are no longer available. To compile a list of task group chairmen and subcommittee secretaries would be close to impossible but the Committee honors them as the unnamed heroes behind much of the real standards development work undertaken over the years by Committee C11. Many of these individuals have been recognized over the years by being presented with one or more Society or Committee awards. Beginning with the first one presented in 1959, the Award of Merit, the Society’s highest award given to an individual, has been presented to 17 members of the committee. In addition to the Award of Merit, the committee has presented members with 56 Awards of Appreciation, two Awards of Recognition, and one Special Service Award. In 2002, the tradition of awarding a Past Chairman Award was begun to honor outgoing main committee chairmen.

Awards of Merit
1959   Henry J. Schweim
1964   Edward R. Murphy
1969   Lloyd H. Yeager
1979  James E. Gillespie  
1980  John D. Shull  
1986  Robert O. Kidd  
1987  David E. Brackett  
1990  Donald O. Baehr  
1990  Archie E. Erwin  
1992  Richard A. Kuntze  
1996  George W. Green  
1998  George D. Shortreed  
2000  Robert A. Wessel  
2002  Michael C. Kerner  
2004  Dick C. Engbrecht  
2006  Keith A. Poerschke  
2011  Gary J. Maylon

Awards of Appreciation
1999  Michael Gardner  
1999  J. Dick Hopkins  
1999  Michael C. Kerner  
1999  Gary J. Maylon  
1999  Keith A. Poerschke  
2000  Hiram P. Ball  
2000  Dick C. Engbrecht  
2000  George W. Green  
2000  Robert L. Madsen  
2000  Gregory S. Ralph  
2003  Joseph R. Hagan  
2003  Thomas E. Palmer  
2003  Paul G. Schlote  
2003  Kerie Turchin  
2003  Brad Wing  
2004  Lee G. Jones  
2004  Brian E. Maag  
2004  John L. Mulder  
2004  George D. Shortreed  
2005  Pamela M. Shinkoda  
2005  Marjorie Spencer  
2006  Mila P. Raymundo  
2007  Joseph A. Feldner  
2007  George W. Green  
2007  Richard E. Kuntze  
2007  Joseph C. Mohen  
2007  Robert A. Wessel
2008  Bob Bruce
2008  Jason W. Fell
2008  Michael C. Kerner
2008  Michael M. Logue
2008  Brad Wing
2009  Russell T. Flynn
2009  George D. Shortreed
2010  William F. Egan
2010  Dick C. Engbrecht
2010  Louis W. Ferrara
2010  Stephen F. Holderness
2010  Russell J. Kenney
2010  Michael C. Kerner
2010  Larry W. Kingston
2010  Gary J. Maylon
2010  John M. Melander
2010  John L. Mulder
2010  Frank E. Nunes
2010  R. Gabe Reitter III
2010  Thomas L. Savoy
2010  Fernando H. Sesma
2010  Robert A. Wessel
2011  Keith A Poerschke
2011  Gregory S. Ralph
2012  Marvin L. Stokoe
2012  Michael J. Tate
2012  Brad Wing
2013  Robert Madsen
2014  Robert N. Mercer
2015  Michael Gardner
2015  Michael Moore
2015  Brad Wing
2015  Bill F. Egan

Awards of Recognition
2002  Dick C. Engbrecht
2013  Donald E. Smith

Special Service Award
2012  Pamela M. Shinkoda
Past Chairman Awards
2002    Dick C. Engbrecht
2007    Keith A. Poerschke
2013    Michael C. Kerner

Committee C11: Standards and Publications

In 1916, the committee published Tentative Definitions of Terms Relating to the Gypsum Industry, ASTM C 11-16T, its first tentative standard. This document contained 19 pages of terms and their definitions and it included an extensive appendix describing how many of the definitions were developed. Additional tentative standards were issued through the early 1920s covering:

- Tentative Standard for Gypsum (C22-23T),
- Tentative Standard for Gypsum Plastering Sand (C35-21T),
- Tentative Standard for Gypsum Wall Board (C36-22T),
- Tentative Standard for Gypsum Plaster Board (C37-22T), and
- Tentative Standard for Gypsum Partition Tile or Block (C52-23T).

By 1924, the committee had several official standards on the books:

- Standard Specification for Calcined Gypsum (C23-22),
- Standard Specification for Gypsum Plasters (C28-21), and
- Standard Methods of Testing Gypsum and Gypsum Products (C26-23).

From these humble beginnings, with just a few standards narrowly focused on gypsum and gypsum products, the committee’s jurisdiction has grown to include standards for fasteners, adhesives, accessories, steel studs, exterior insulating and finish systems, and numerous other related materials and accessories, as well as many of the test methods used to evaluate these materials and the specifications for using these products in construction. The list below contains all 57 of the active standards currently under the jurisdiction of Committee C11. And, this rather extensive list does not include the many standards that have been transferred to other committees or withdrawn over the years. Nor does it contain the draft standards currently under consideration by task groups within the committee.

- C11-13 Standard Terminology Relating to Gypsum and Related Building Materials and Systems
- C28/C28M-10 Standard Specification for Gypsum Plasters
• C59/C59M-00(2011) Standard Specification for Gypsum Casting Plaster and Gypsum Molding Plaster
• C61/C61M-00(2011) Standard Specification for Gypsum Keene's Cement
• C317/C317M-00(2010) Standard Specification for Gypsum Concrete
• C318/C318M-13 Standard Specification for Gypsum Formboard
• C471M-14 Standard Test Methods for Chemical Analysis of Gypsum and Gypsum Products (Metric)
• C473-12 Standard Test Methods for Physical Testing of Gypsum Panel Products
• C474-13 Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction
• C475/C475M-12e1 Standard Specification for Joint Compound and Joint Tape forFinishing Gypsum Board
• C645-14 Standard Specification for Nonstructural Steel Framing Members
• C754-11 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
• C840-13 Standard Specification for Application and Finishing of Gypsum Board
• C841-03(2013) Standard Specification for Installation of Interior Lathing and Furring
• C842-05(2010)e1 Standard Specification for Application of Interior Gypsum Plaster
• C847-14a Standard Specification for Metal Lath
• C926-14a Standard Specification for Application of Portland Cement-Based Plaster
• C933-14 Standard Specification for Welded Wire Lath
• C954-11 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
• C955-11c Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
• C956-04(2010) Standard Specification for Installation of Cast-In-Place Reinforced Gypsum Concrete
• C1002-14 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
• C1007-11a Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
• C1032-14 Standard Specification for Woven Wire Plaster Base
• C1047-14a Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
• C1063-14d Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
• C1177/C1177M-13 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
• C1178/C1178M-13 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
• C1264-14a Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products
• C1280-13a Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
• C1396/C1396M-14a Standard Specification for Gypsum Board
• C1397-13 Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage
• C1467/C1467M-00(2012) Standard Specification for the Installation of Molded Glass Fiber Reinforced Gypsum Parts
• C1513-13 Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
• C1535-05(2011) Standard Practice for Application of Exterior Insulation and Finish Systems Class PI
• C1629/C1629M-14a Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
• C1658/C1658M-13 Standard Specification for Glass Mat Gypsum Panels
• C1764-12 Standard Test Methods for Non Metallic Plaster Bases (Lath) Used with Portland Cement Based Plaster in Vertical Wall Applications
• C1787-14 Standard Specification for Installation of Non Metallic Plaster Bases (Lath) Used with Portland Cement Based Plaster in Vertical Wall Applications
• C1788-14 Standard Specification for Non Metallic Plaster Bases (Lath) Used with Portland Cement Based Plaster in Vertical Wall Applications
• C1789-14 Standard Test Method for Calibration of Hand-Held Moisture Meters on Gypsum Panels

In addition to standard specifications, guides, practices, and test methods, the Committee sponsored a Symposium on the Chemistry and Technology of Gypsum and Gypsum Products Atlanta, Georgia, on April 14–15, 1983. The papers from the symposium were published as The Chemistry and Technology of Gypsum, ASTM STP861, edited by Richard A. Kuntze of Ontario Research Foundation in Mississauga, Ontario, Canada. The symposium focused on properties and testing of synthetic, or “byproduct” gypsum used as a raw material in the manufacture of gypsum products. These synthetic materials were not currently addressed in ASTM standards and the symposium raised awareness across the industry as to the importance and usability of synthetic gypsum from specific sources.
The papers presented at the symposium, and their authors, were:

- Physical Testing of Gypsum Board Per ASTM C473—Robert F. Acker
- Gypsum Analysis with the Polarizing Microscope—George W. Green
- The Effect of Sorbed Water on the Determination of Phase Composition of CaSO$_4$·H$_2$O Systems by Various Methods—Danica H. Turk and Larbi Bounini
- A Simple Apparatus for Measurement of the Hydration Ratio of Plasters and Plaster Rocks—Etienne Karmazsin
- Determination of Sulfur Trioxide in Gypsum—S. Goswami and D. Chandra
- Rapid Multielement Analysis of Gypsum and Gypsum Products by X-Ray Fluorescence Spectroscopy—Vladimir Kocman
- The Relationship Between Water Demand and Particle Size Distribution of Stucco—Lydia M. Luckevich and Richard A. Kuntze
- Retardation of Gypsum Plasters With Citric Acid: Mechanism and Properties—Thomas Koslowski and Udo Ludwig
- Byproduct Gypsum—Jean W. Pressler
- Assessment of Environmental Impacts Associated with Phosphogypsum in Florida—Alexander May and John W. Sweeney
- Evaluation of Radium and Toxic Element Leaching Characteristics of Florida Phosphogypsum Stockpiles—Alexander May and John W. Sweeney
- Drying and Agglomeration of Flue Gas Gypsum—Franz Wirsching

Clearly the members who have served on Committee C11 over the years have accomplished much. But this is not a committee to “rest on its laurels.” Technology continues to evolve and all of the Committee’s standards are recognized to be “living documents” that demand the full attention of the members on an ongoing basis to keep them current and relevant to today’s construction marketplace.

Today’s committee officers, subcommittee officers, and members thank, honor, and remember all of the past and current task group, subcommittee, and main committee officers as well as the companies or organizations by whom they were supported in this work. In addition, we thank all those who were not officers but who gave of their time, knowledge, and talents for the development and continual maintenance of the standards that continue to shape our industry today. Without their pioneering efforts, our work today would no doubt be much more difficult. It is the hard work and dedication of these individuals that has enabled Committee C11 to become and remain one of the most effective committees in ASTM—a tradition born a century ago—and one in which all members, past and present, can take great pride. Committee C11 never forgets that, regardless of its past, it is still a work in progress.

Robert A. Wessel

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