National Gypsum

Thermal Mass in Light Weight Construction

IV Thermal Mass Workshop

December 5, 2010

Topics

- National Gypsum Overview
- ThermalCORE™
  - PCM
  - Panel Properties
  - Small Scale Testing
  - Large Scale Projects
- Product Design Options
- More Information

Introduction to National Gypsum

- 2nd largest U.S. producer of gypsum drywall
- 23% market share
- 21 wallboard plants strategically located
- Marketed under Gold Bond® brand
- Privately held

National Gypsum

Gypsum wallboard – one of the 85 greatest innovations

National Gypsum

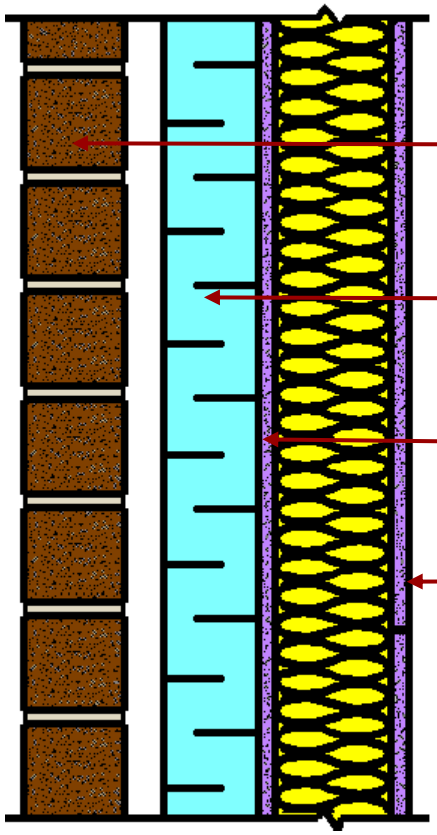
Primary Use

- Light weight
- Easy to install
- Fire *resistance*

National Gypsum

Changing Wall Components

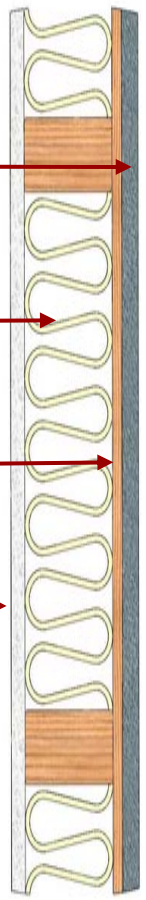
Commercial Application **Residential Application**



Potential Impact Areas

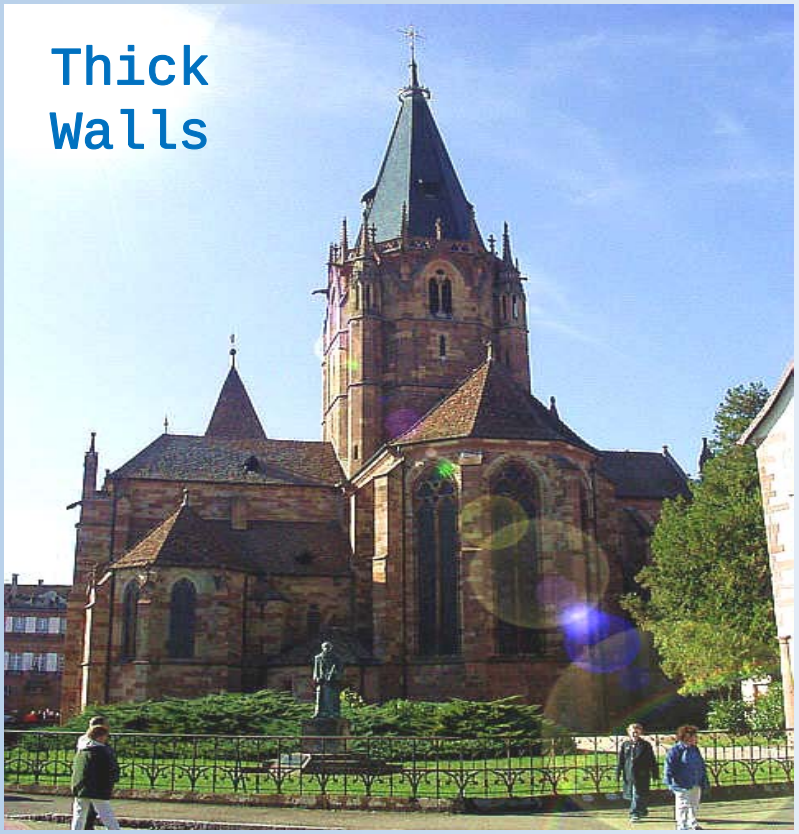
- **Exterior Cladding**
- **Insulation**
- **Sheathing**
- **Interior Drywall**

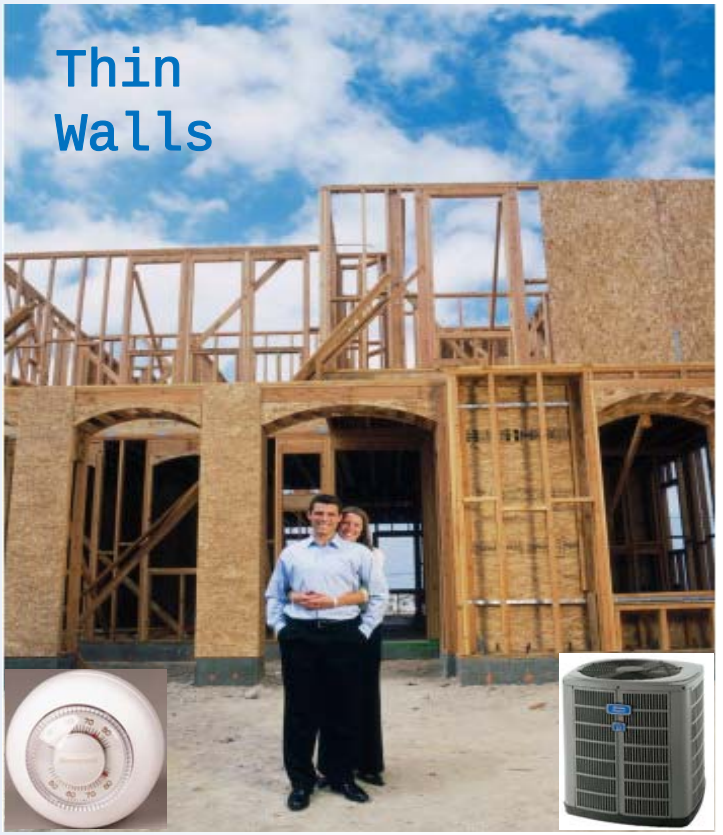
Indoor Air Quality
Mold Resistance
Acoustics
Durability



National Gypsum

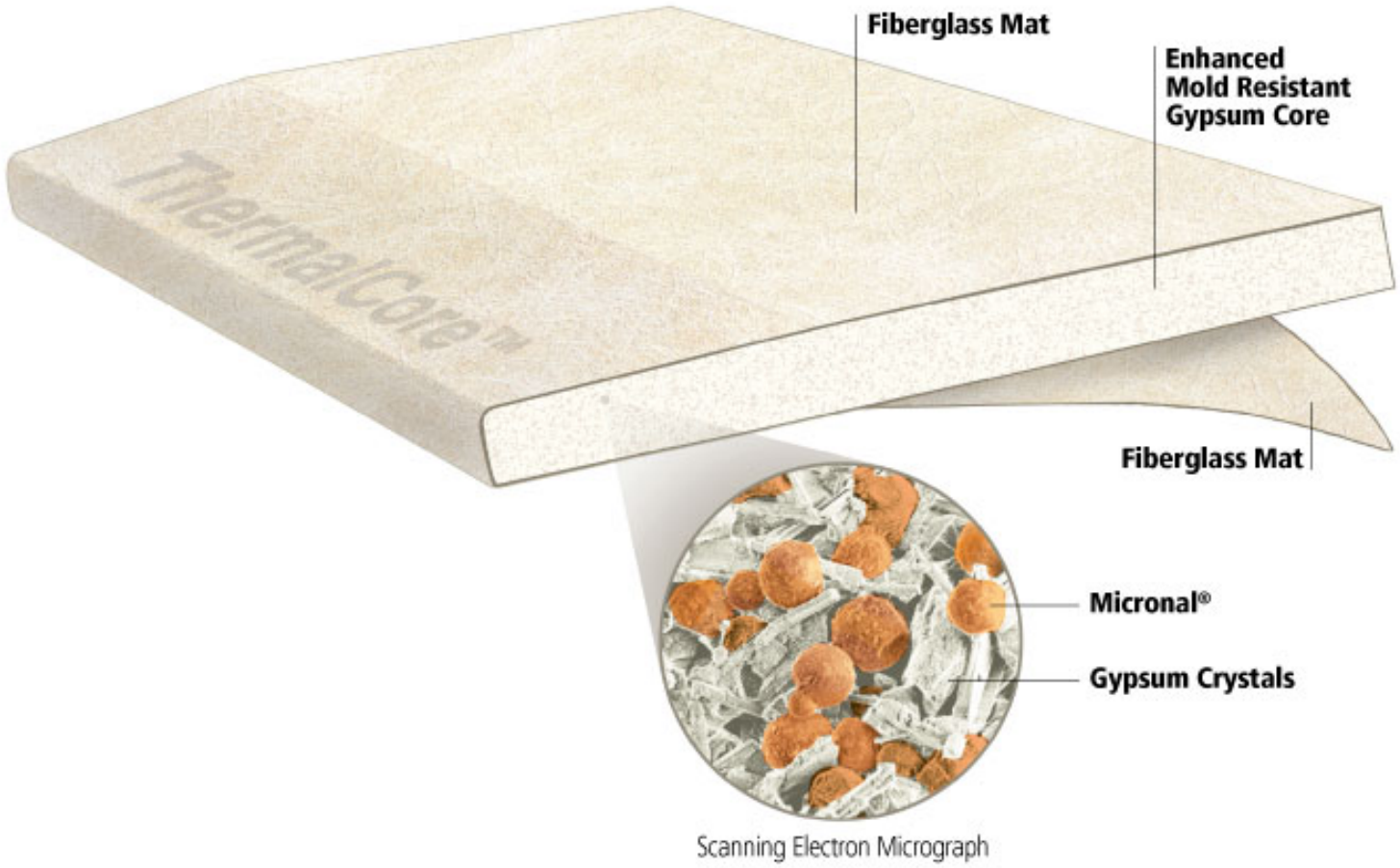
What if Thin Walls Acted Like Thick Walls?





National Gypsum

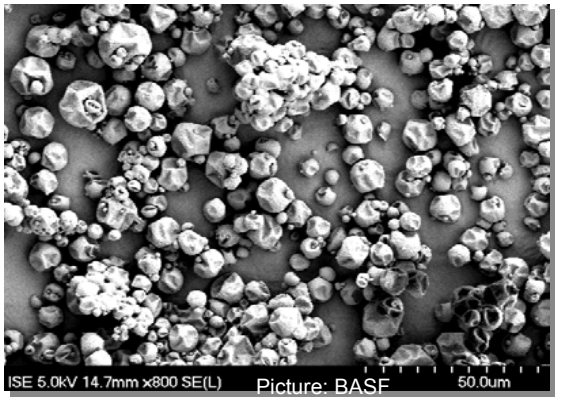
ThermalCORE™ Panel



Scanning Electron Micrograph

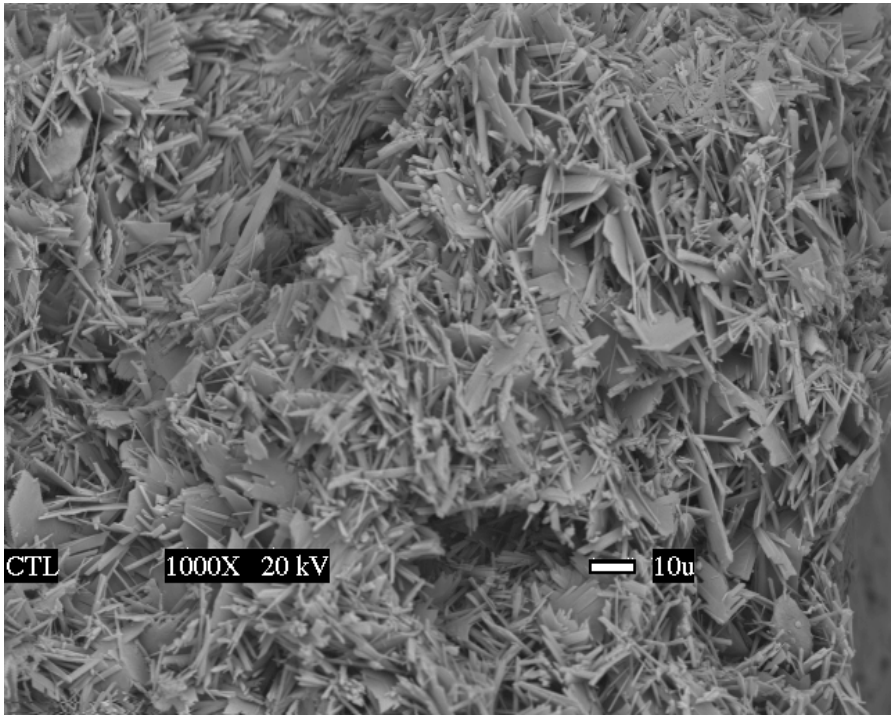
Micronal®

- Manufactured by BASF
- Paraffin micro-encapsulated in acrylic shell
- Durable; no leaking of PCM; no damaged capsules
- Tested 10,000 cycles freeze/thaw cycles; DSC unchanged (stable melting point)
- Available in 70° F, 73° F and 79° F melting points
- Favorable toxicity profile

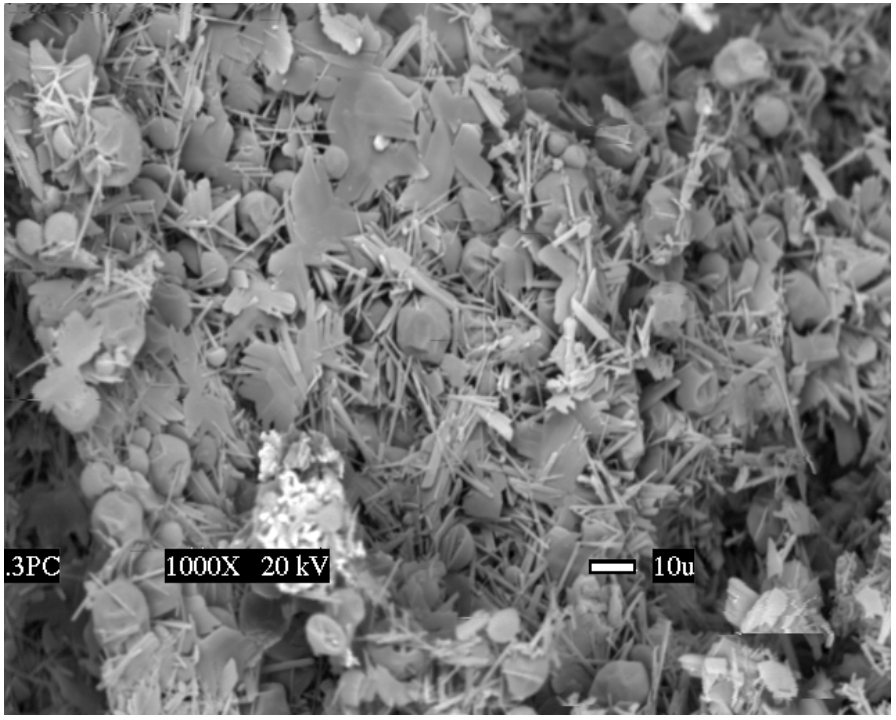


National Gypsum

Micrographs of ThermalCORE Core



Without Micronal



With Micronal

National Gypsum

ThermalCORE Properties

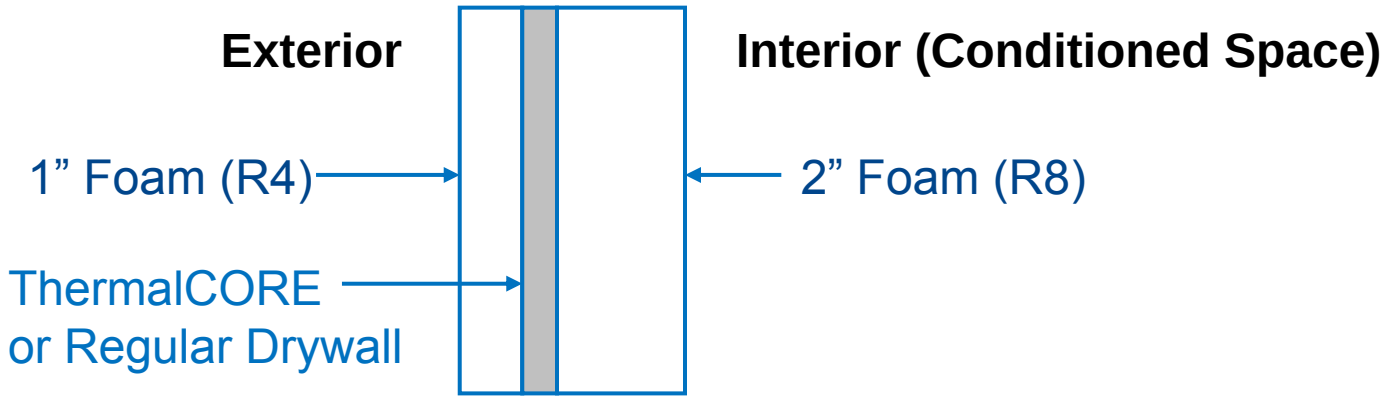
- Meets ASTM C1396 Standard Specification for Gypsum Board
- ~2.1 lb/ft^2 for 1/2”
- Optional - Moisture resistant core, mold resistant
- Hangs and finishes like regular drywall; no special tools or handling required
- Latent Heat of 22 BTU/ft^2

Combustion/Fire Properties

- Combustible per ASTM E136
- ASTM E84 Flame spread/smoke developed:
  - Class B per IBC
- Room corner burn (UL 1715):
  - Performed better than birch veneer paneling
- Dust has combustion properties comparable to or better than wood saw dust.

Preliminary PCM Performance Evaluation*

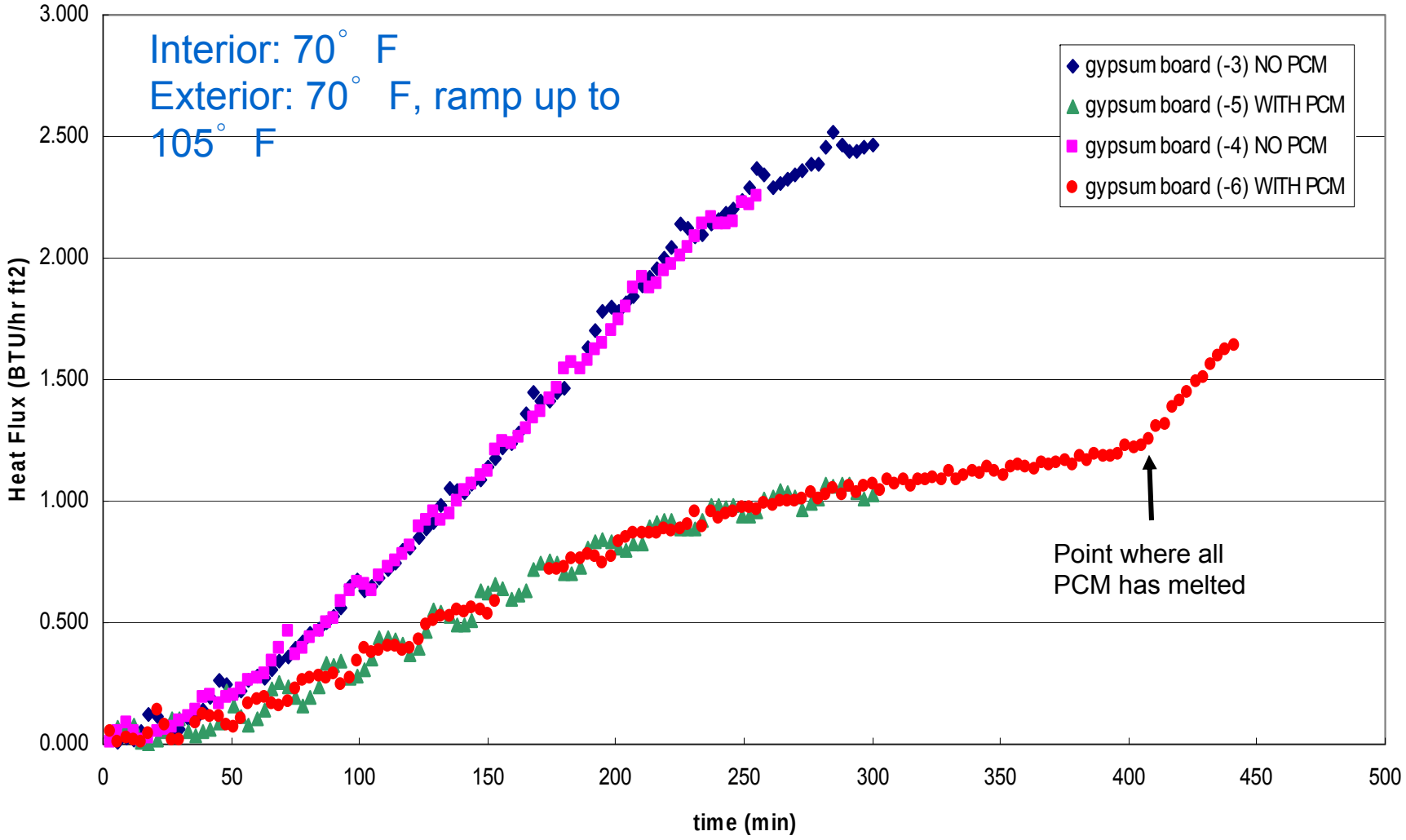
- Measured heat flux, comparing ½” drywall to ThermalCORE (79° F melting point) using dynamic ASTM C518 test
- Summer and winter cycles (300 minute temperature ramp; 300 minutes isothermal)
- Used layered assembly:



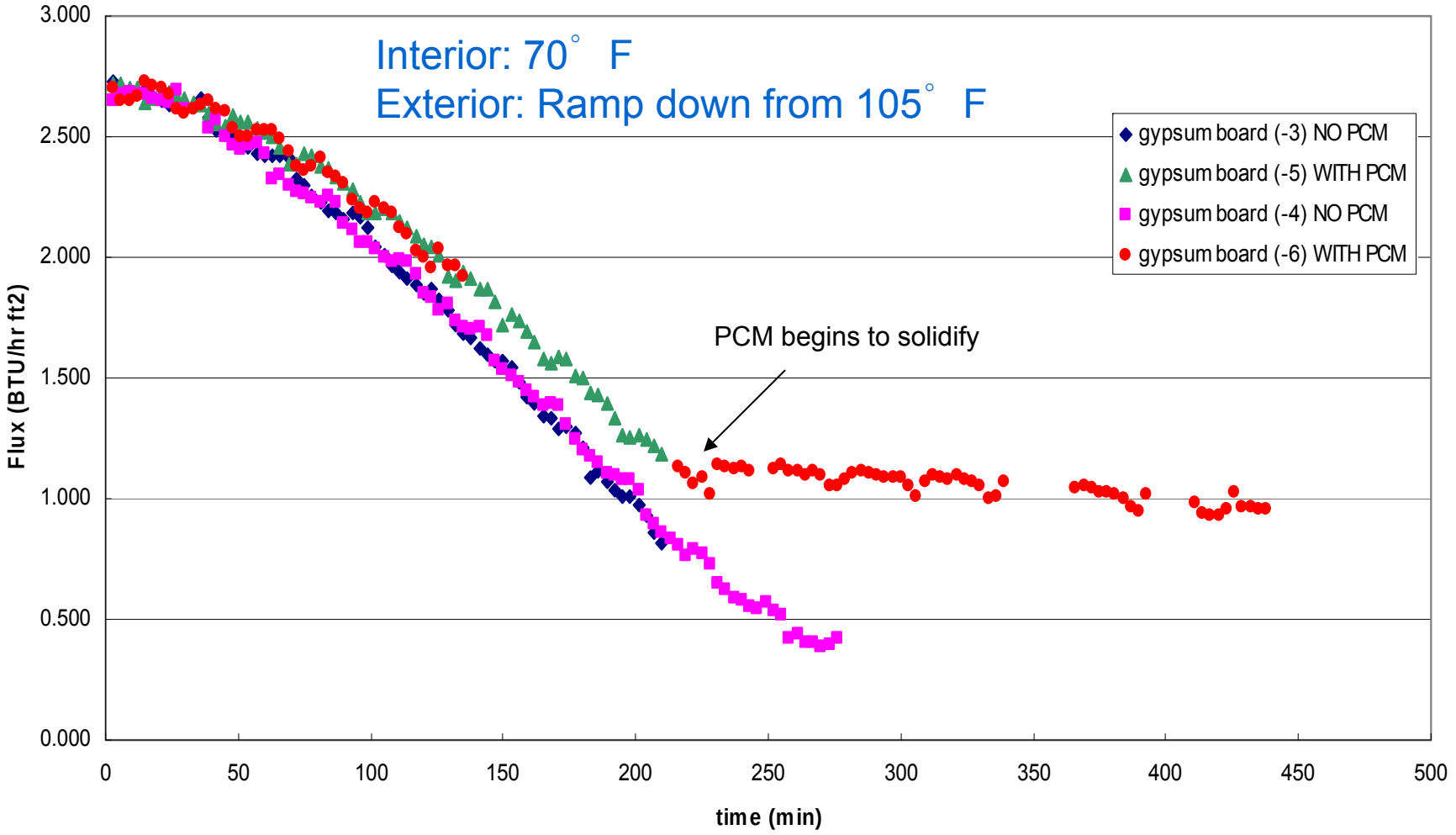
* Conducted by R&D Services, Inc

National Gypsum

Heat Flux – Summer Warm up (Charge)



Heat Flux – Summer Cool Down (Discharge)



Reduction in Heat Gain from Conditioned Space - Summer

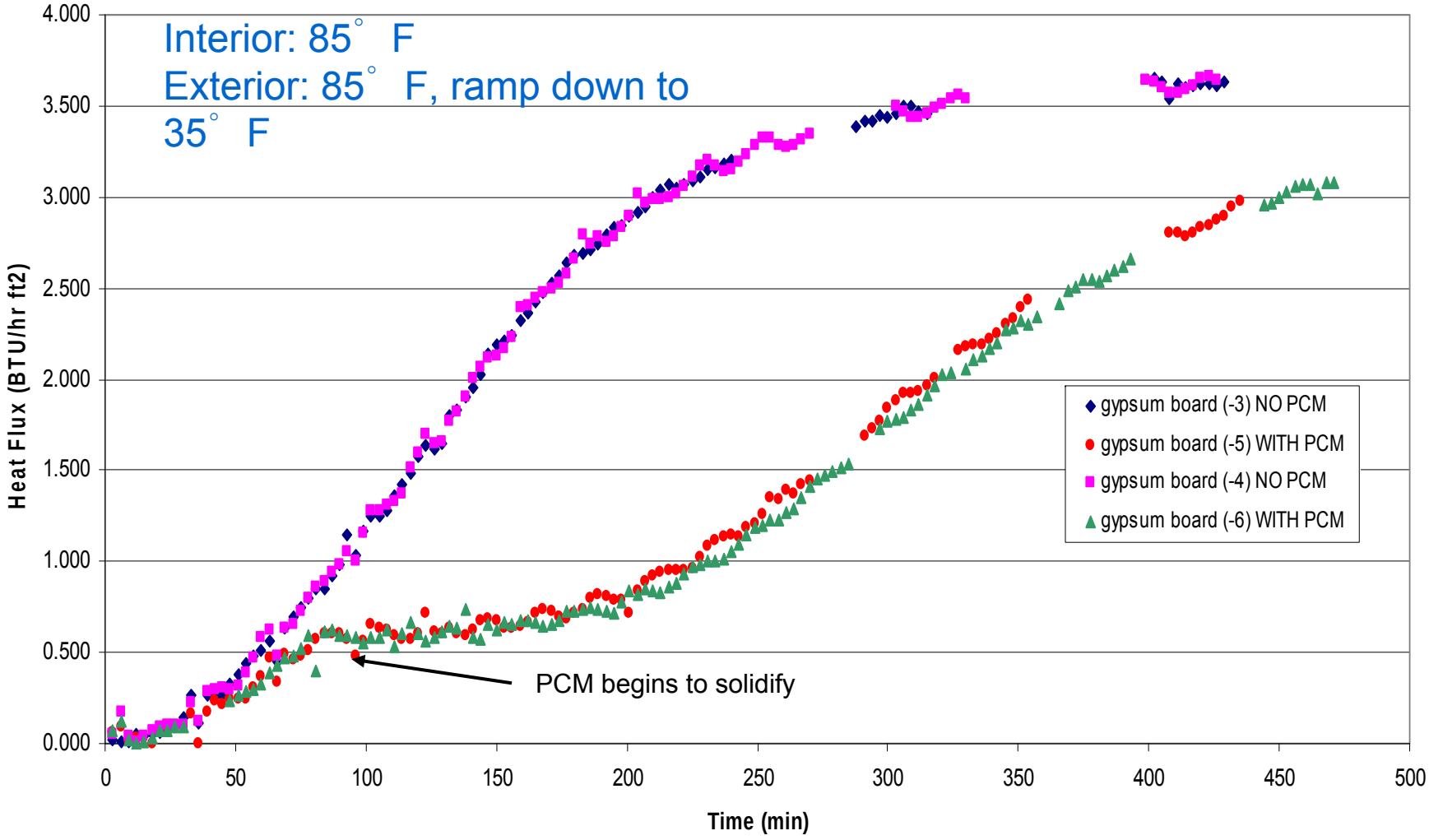
		Warm Up	Cool Down **	Total
Heat Flow Integral*	Reg. Gyp Board	363.3	457.2	820.5
	ThermalCORE	169.0	540.6	709.6
Net Reduction (Btu.min/ft2.hr)		194.3	-83.4	110.9
Cycle Total (Btu/ft^2)				1.85
% Reduction				13.5 %

* Heat flow x Time

** Negative result represents increase

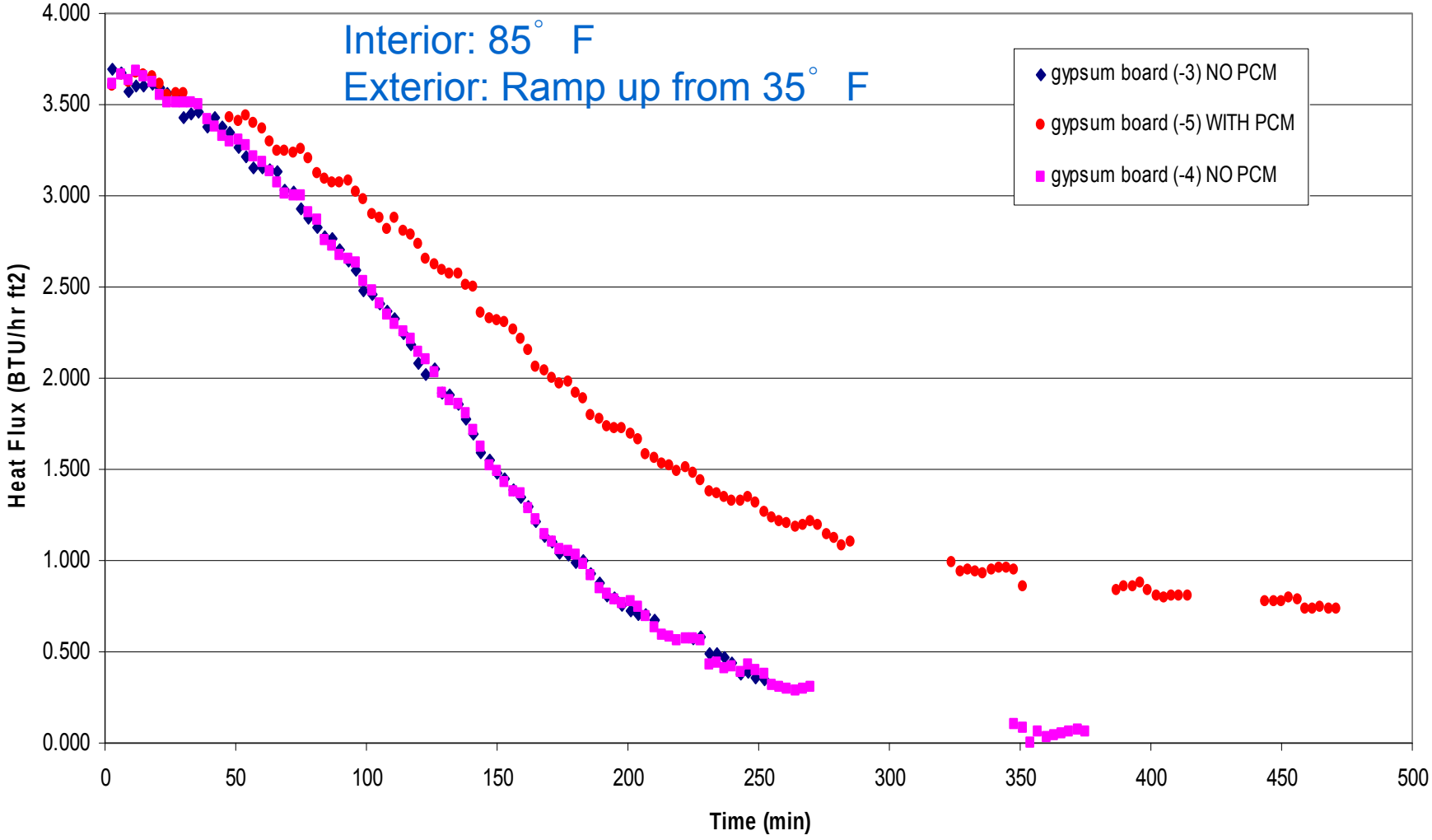
National Gypsum

Heat Flux - Winter Cool Down (Discharge)



National Gypsum

Heat Flux – Winter Warm up (Charge)



National Gypsum

Reduction in Heat Loss from Conditioned Space - Winter

		Cool Down	Warm Up **	Total
Heat Flow Integral*	Reg. Gyp Board	575.3	520.8	1096.1
	ThermalCORE	222.1	701.5	923.6
Net Reduction (Btu.min/ft^2.hr)		353.2	-180.7	172.5
Cycle Total (Btu/ft^2)				2.87
% Reduction				15.7 %

* Heat flow x Time

** Negative result represents increase

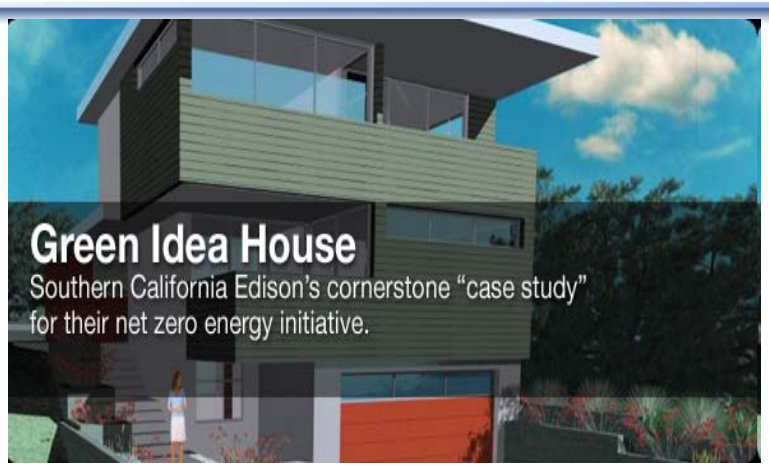
National Gypsum

ThermalCORE™: Projects

THE GREEN DREAM

Popular Science

Greenwich, NY



Hermosa Beach, CA

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

National Gypsum

Prototypes and Design Options

Prototypes:

- ½” interior product, 73° F melting pt
- 5/8” sheathing with moisture resistant core, 79° F melting pt
- ~22 BTU/ft^2 latent heat

Design Options:

- Placement: interior/exterior, wall and/or ceiling
- Melting point: 73° F, 79° F
- PCM loading / latent heat
- Thickness: ½”, 5/8”

National Gypsum

Information @ www.thermalcore.info

National Gypsum® ThermalCORE™ Panel

Wall panel with latent heat storage capacity

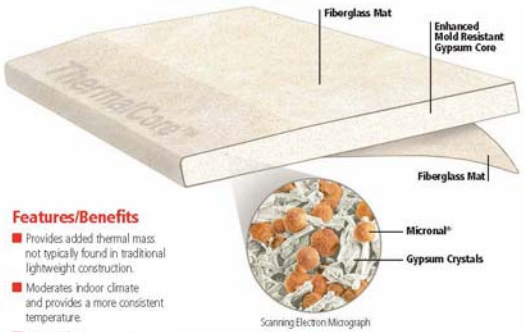
Description

National Gypsum's 1/2" ThermalCORE Panel contains Micronal®* phase change material (PCM) produced by BASF. Micronal is a microencapsulated, high-purity paraffin wax. This material changes phase from solid to liquid when it reaches 73° F, absorbing thermal energy to help moderate a room's temperature. When temperatures fall, the wax solidifies and releases heat. This alternating process of melting and solidifying allows ThermalCORE to absorb daytime temperature peaks, ideally providing a more consistent room temperature.

ThermalCORE is faced with a fiberglass mat and is manufactured with an enhanced mold resistant core.

For ease of installation, ThermalCORE comes standard with GridMarX® guide marks printed on the surface. These guide marks align with standard building dimensions and help to quickly identify fastener lines for stud and joint framing. The panels require a skim coat and will accept decoration similar to standard gypsum board.

* *Micronal® is a registered trademark of BASF.*



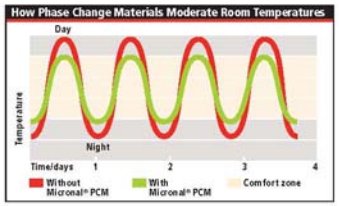
Scanning Electron Micrograph

Features/Benefits

- Provides added thermal mass not typically found in traditional lightweight construction.
- Moderates indoor climate and provides a more consistent temperature.
- Potential for greater energy efficiency through latent heat storage.
- Phase change material is contained within virtually indestructible microscopic acrylic capsules which will not leak.
- BASF has subjected Micronal to 10,000 cycles to verify durability.
- Fiberglass facer and treated core provides extra protection against mold growth per ASTM D 3273, achieving a score of 10, the best possible score.
- Handles and installs like regular gypsum board.

Technical Data

PHYSICAL PROPERTIES	
Nominal Thickness	1/2"
Standard Width	4'
Standard Length	8'
Nominal weight (lbs./sf)	2.1
Edges	Tapered
Surface Burning Characteristics	Class B
Combustibility (per ASTM C 136)	Combustible
Mold Resistance (per ASTM D 3273)	10
Latent Heat (BTU/sf)	22 (Approx.)



ThermalCORE™
PCM Panel by National Gypsum

www.thermalcore.info

Corporate Headquarters
National Gypsum Company
2001 Rexford Road
Charlotte, NC 28211
Phone: (704) 365-7300
Web: nationalgypsum.com
nationalgypsum.com/espanol

Technical Information
Phone: (800) NATIONAL
(800) 628-4662
Fax: (800) FAX-NGC1
(800) 329-6421

National Gypsum.

111109 11/09

National Gypsum

Questions?

Contact info:

Jennifer Willson
Manager, Innovation and Product Development
National Gypsum Company
704-551-5830
jmwillson@nationalgypsum.com