

HAMMOND

EXPANDERS™

USA

A Division of HAMMOND GROUP, INC.

HAMMOND

EXPANDERS™

UK, LLC

A Division of HAMMOND GROUP, INC.

HAMMOND

EXPANDERS™

MALAYSIA

A Division of Asia Litharge Sdn. Bhd.

[www.hammondexpanders.com](http://www.hammondexpanders.com)

# Agenda

1. Who is HGI?
2. What is the history of Hammond Expanders?
3. What is expander?
4. How does it work?
5. Why should you outsource expander?
6. Why should you buy from Hammond Expanders?
7. How can you save additional money?
8. Where do we go from here?

# Who is HGI?

- Halox – Anti-corrosive pigments
- Halstab – Plastic stabilizers
- Hammond Lead Products – Lead chemicals for batteries and glass
- Total Transportation – Transportation systems provider
- Hammond Expanders – Additives for lead acid batteries

# What is the History of Hammond Expanders?

- Over 60 years experience
- World leader in technology
- State-of-the-art Technical Center
- Active in R&D for negative expanders
- Manufacturing facilities in the USA, UK & Asia

# What is the History of Hammond Expanders?

We are the world's leading producer of negative expanders for over 60 years. Some current customers include:

- Johnson Controls Inc.
- Enertec
- East Penn Manufacturing
- C & D Technologies
- Yuasa
- Fiamm
- Douglas
- Enersys

# What is expander?

Barium Sulfate

Lignosulfonate

Carbon Black

Wood Flour

Soda Ash

Graphite



# Expander production

- Principal method of manufacturing- Ball milling



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# How does it work?

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# Barium Sulfate

- Promotes formation of small crystallites of lead sulfate during discharge.
- Prevents passivation of the active material by lead sulfate.
- Recharge of the lead sulfate is facilitated.

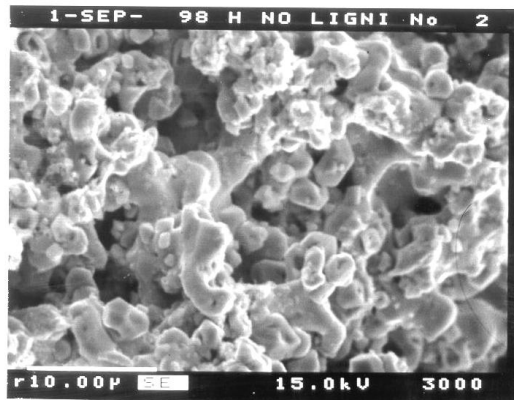
# Structural Characteristics Of Barium And Lead Sulfates

	<b>BaSO<sub>4</sub></b>	<b>PbSO<sub>4</sub></b>
<b>Cation-O bond length (Å)</b>	<b>2.952</b>	<b>2.87</b>
<b>S-O bond length (Å)</b>	<b>1.478</b>	<b>1.490</b>

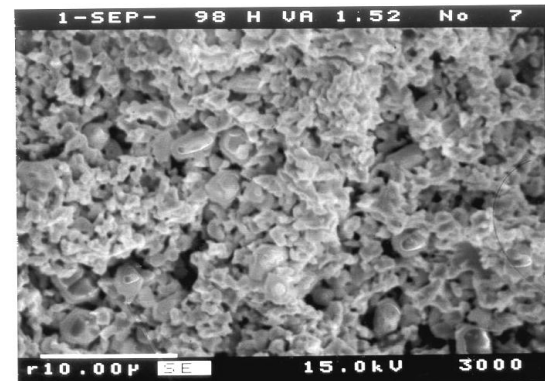
# Lignosulfonate

- Increases surface area of NAM
- Stabilizes the active material structure

# Effect of Lignosulfonate on Structure of NAM



No Organic



0.5% Vanisperse A

# Carbon Black

- Increases the conductivity of the NAM
- Improves initial formation

# Why should you outsource expander?

# Why should you outsource expander?

- Lets you do what you do best – make batteries

# Why should you outsource expander?

- Save money by reducing:
  - Inventories
  - Energy costs
  - Housekeeping costs
  - Capital outlays



# Why should you buy from Hammond Expanders?

1. Technical Advantage
2. Operational Advantage
3. Economical Advantage

# Technical Advantage

- Quality control
- ISO 9001:2000 certified
- Continuous research
- Technical support



# Technical Advantage

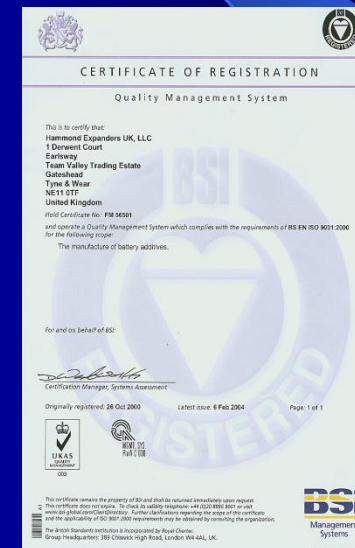
Advanced Technical Center for R&D/QC



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# Technical Advantage

- ISO 9001:2008 Certified



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# Technical Advantage

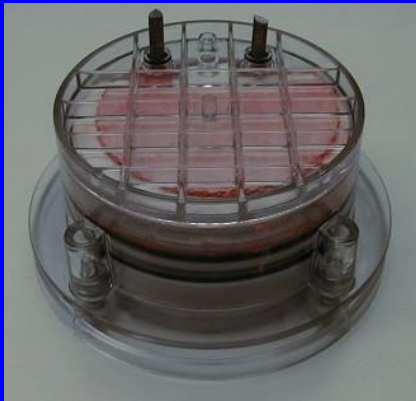
## Maccor and Bitrode Testing Equipment



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# Technical Advantage

- Research and development
  - New products
  - New materials
  - ALABC



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# Technical Advantage

- Hammond's electrochemical testing ability

<b>Automotive</b>	<b>Industrial</b>
Cold cranking	Capacity
Reserve capacity	Cycle life
Charge acceptance	Float behavior
Gassing rate	
Cycle life	

# Technical Advantage

- Analytical test equipment
  - Particle size analyzer
  - UV spectrophotometry
  - DSC
  - TGA
  - Surface Area and Porosity (BET)
  - ICP
  - X-ray Diffraction

# Technical Advantage

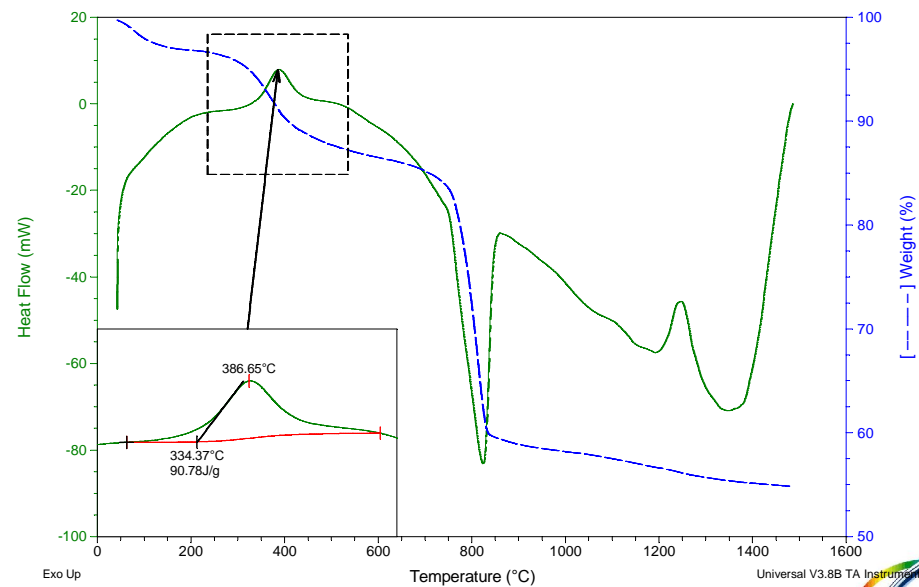
## Typical DSC/TGA Chart

### HE-631

Sample: HE-631 XRF  
Size: 22.6750 mg  
Method: RT->1500°C;  $\beta$ =20°C/min.  
Comment: N2 Purge=100mL/min.

DSC-TGA

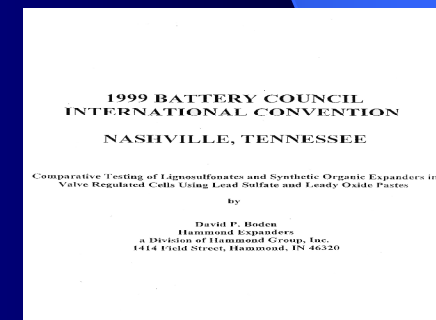
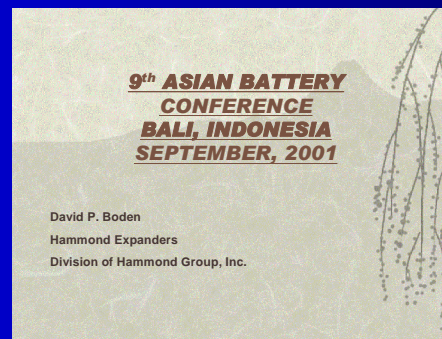
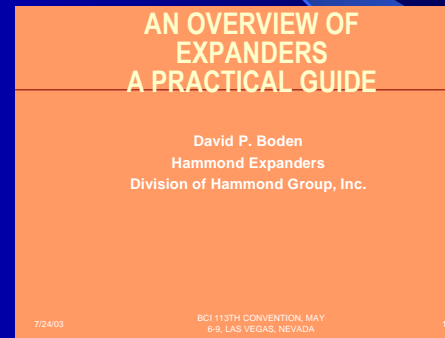
File: HE-631 XRF SDT.001  
Operator: C. Jay Lundgren  
Run Date: 16-May-03 14:13  
Instrument: SDT Q600 V5.0 Build 63



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# Technical Advantage

- Technical support
  - Expander selection
  - Operational issues
- Service to industry
  - Over 60 years
  - Uncompromising quality



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# Why should you buy from Hammond Expanders?

1. Technical Advantage
2. Operational Advantage
3. Economical Advantage

# Operational Advantage

- New Manufacturing facility
  - Standardized equipment
  - Simplified process flow
- Minimize cross-contamination
  - Separate industrial and automotive production lines
  - Off-load smaller volume products
- Worldwide coverage
  - Plants in the USA , UK & Asia

# Why should you buy from Hammond Expanders?

1. Technical Advantage
2. Operational Advantage
3. **Economical Advantage**

# Economical Advantage

- Economies of scale and scope
  - Raw material purchasing power
- Ability to call on HGI resources
- Focus on simplified product flow
  - Reduces manufacturing costs
  - Reduces the cost of quality
  - Lowers inventories
- Commitment to continuous improvement

# Economical Advantage

- No overhead costs
- No R&D costs
- Low component cost and Hammond's technical ability yields high value.



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# Economical Advantage

- Custom weighed disposable paper bags allow easy and clean batch introduction (dry) per a 1 bag per your batch weight
- Keeps your plant clean!



# How can you save additional money?

- Standardize automotive expanders to Hammond's proprietary HE-631
- Standardize industrial expanders to Hammond's proprietary HE-5.5

Where do we go from here?

# Hybrid/Electric Vehicle Expanders!

- New HE-C-6 MaxLife for High-Rate-Partial-State-of-Charge applications

H $\Delta$ MMOND

HE-C-6-MaxLife<sup>TM</sup>

HRPSoC (High-Rate-Partial-State-of-Charge) Expander

EXPANDERS<sup>TM</sup>

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Thank you

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