



PERMANENT • HIGH CONTRAST • HIGH RESOLUTION • COLORS

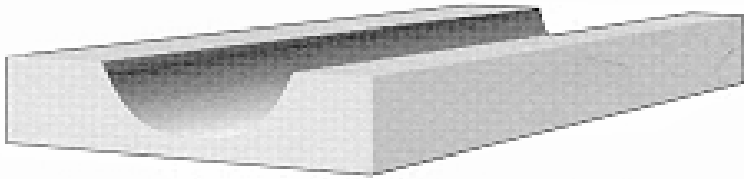
## TherMark Overview 2008



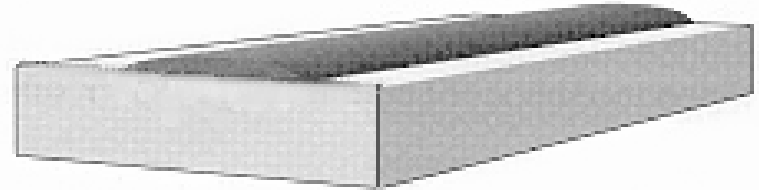
# TherMark Technology Fundamentals

# Major Types of Laser Marking

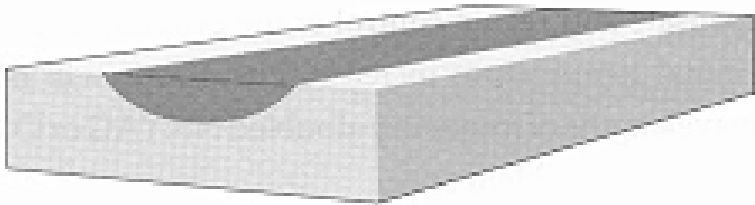
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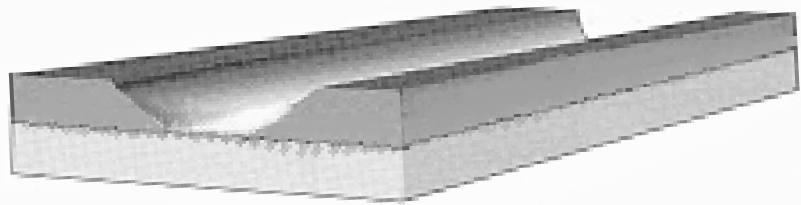
Ablation



Laser bonding (TherMark)

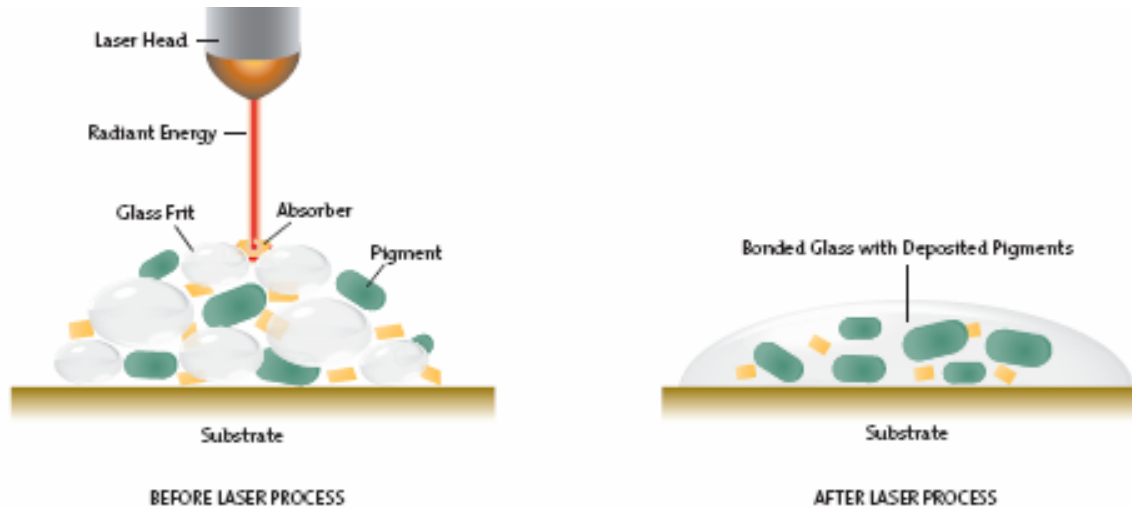


Carbon migration



Coating removal

# TherMark Patented Process



1. Apply the proprietary laser marking material
2. A laser is used to draw a pattern, fusing the material to the surface
3. Remove excess marking material

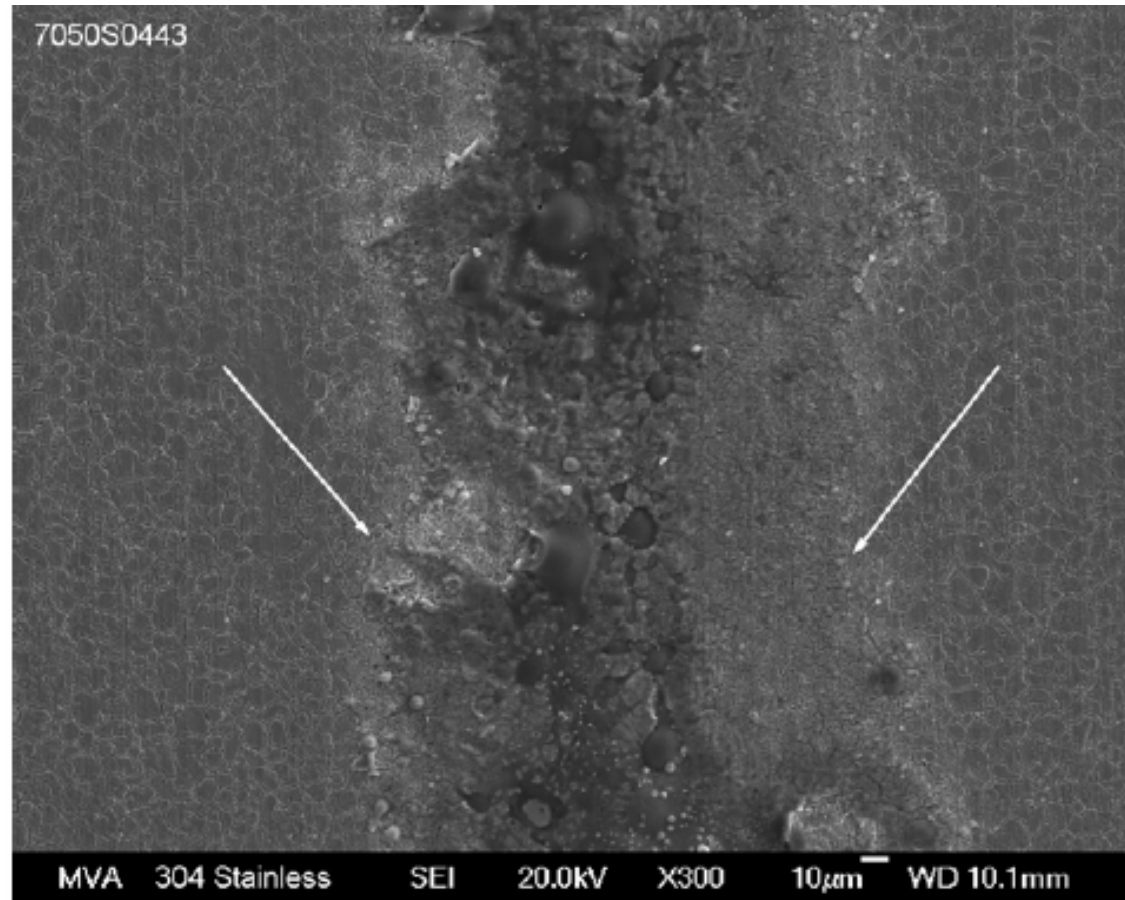
# TherMark Technology Benefits

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- Permanent
- High contrast
- High resolution
- Preserves substrate integrity
- Increase ROI on laser systems
- Quick and easy to apply
- Color (glass & ceramics)

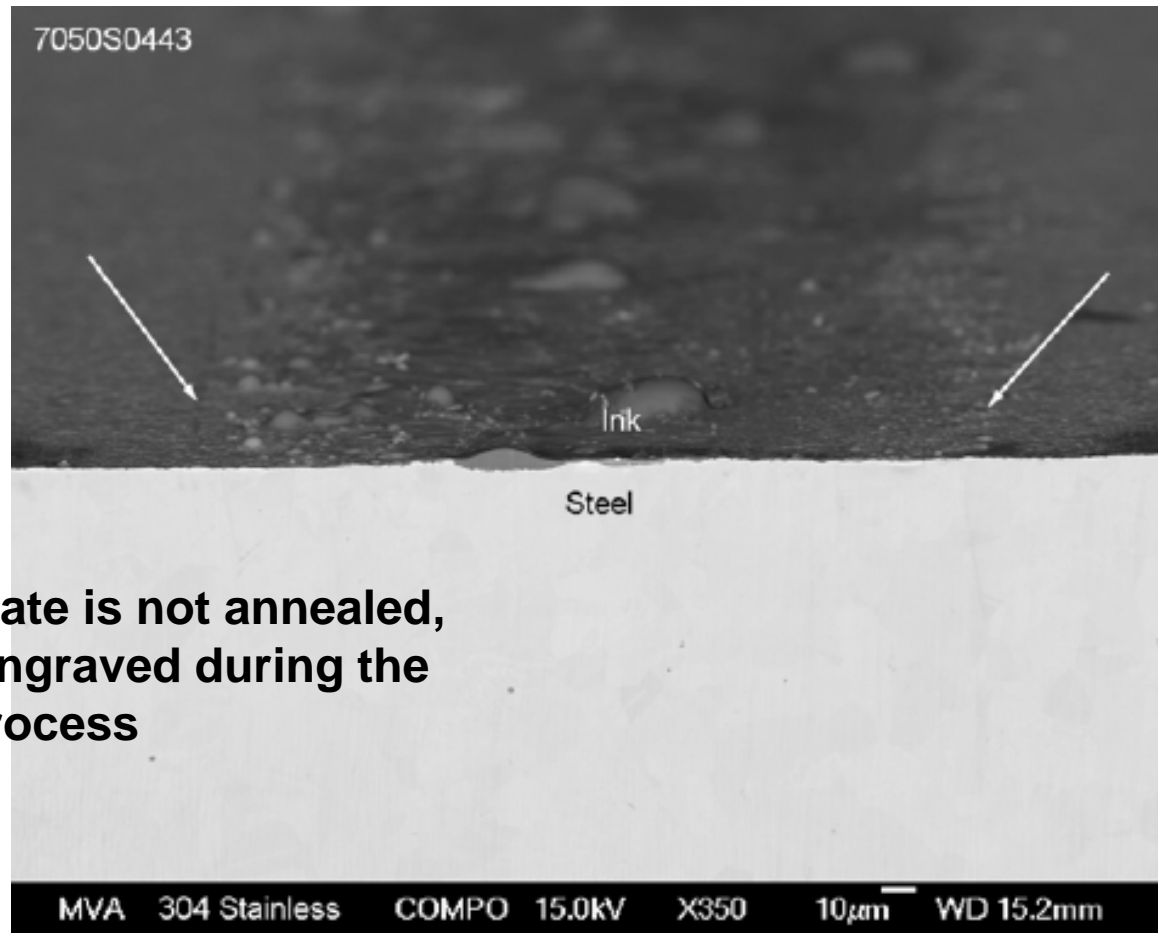
# LMM14 on Stainless Steel 304

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Arrows denote extent of wetting

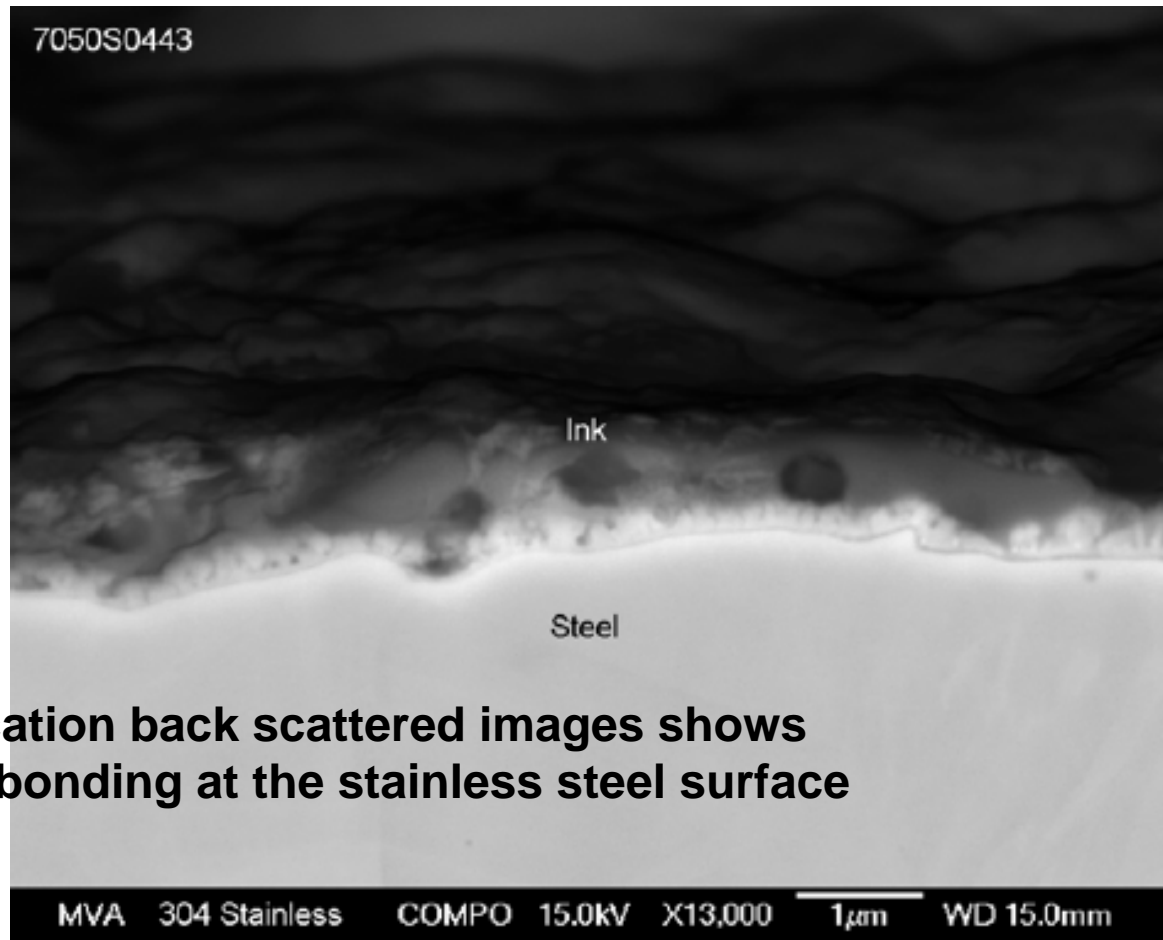
# LMM14 on Stainless Steel 304



**Steel substrate is not annealed, ablated or engraved during the TherMark process**

# LMM14 on Stainless Steel 304

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High magnification back scattered images shows Molybdenum bonding at the stainless steel surface

# Laser Bonding Process Approvals

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- Department of Defense, standard practice identification marking of U.S. military property
  - MIL-STD-130M
- NASA approved laser marking process
  - NASA-STD-6002A
  - NASA-HDBK-6003A
- Rolls Royce marking standard
  - JES 131
- Automotive Industry Action Group (AIAG)
  - B-17 2D Parts marking guideline



Why TherMark?

# Why use TherMark versus other Alternatives?

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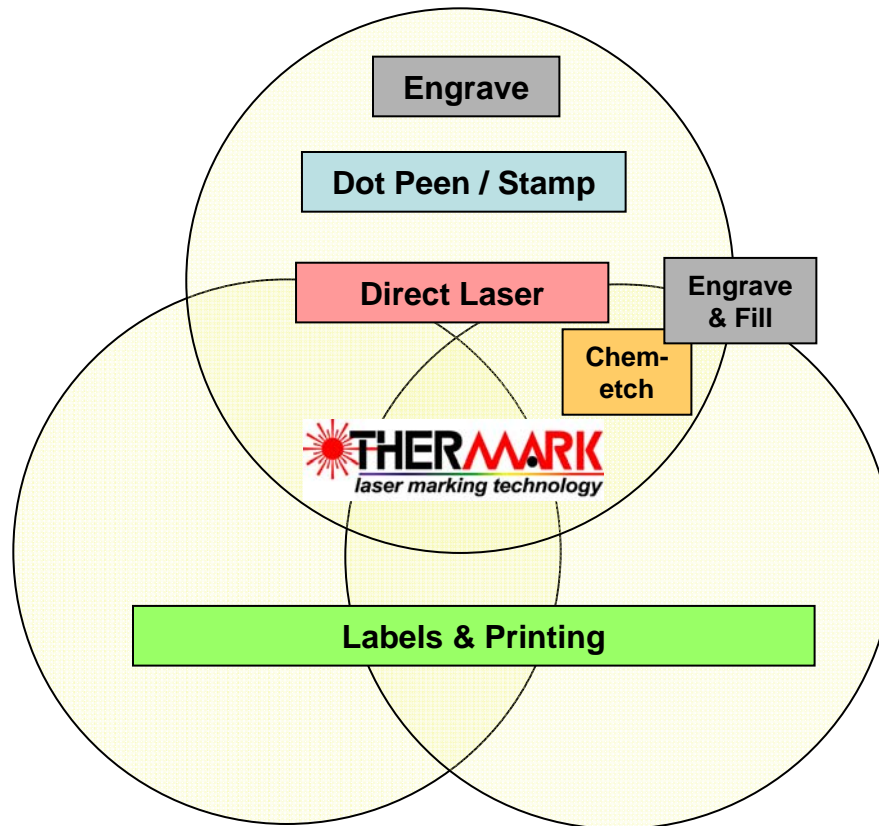
- Usually a combination of factors
  - Difficult to mark substrates
  - Requirement for permanence
  - Harsh environment (high temperature, chemicals, moisture etc)
  - When high contrast & resolution are needed for machine readability
  - Aversion to material changes or substrate damage

# Why TherMark?

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## Permanence

(Chemical/Temp/UV/Abrasion)



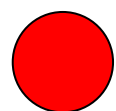
## Contrast & Resolution

(Readability / coding / branding / instructions / warnings etc.)

## Substrate Mark-ability & Integrity

(Non-ferrous metals / alloys / plastics / plated surfaces / glass & ceramic etc.)

# Sweet Spots & Opportunities

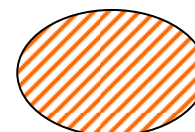


**TherMark  
Sweet Spot**

Where combination of permanence, substrate and mark quality mean that we are the only solution

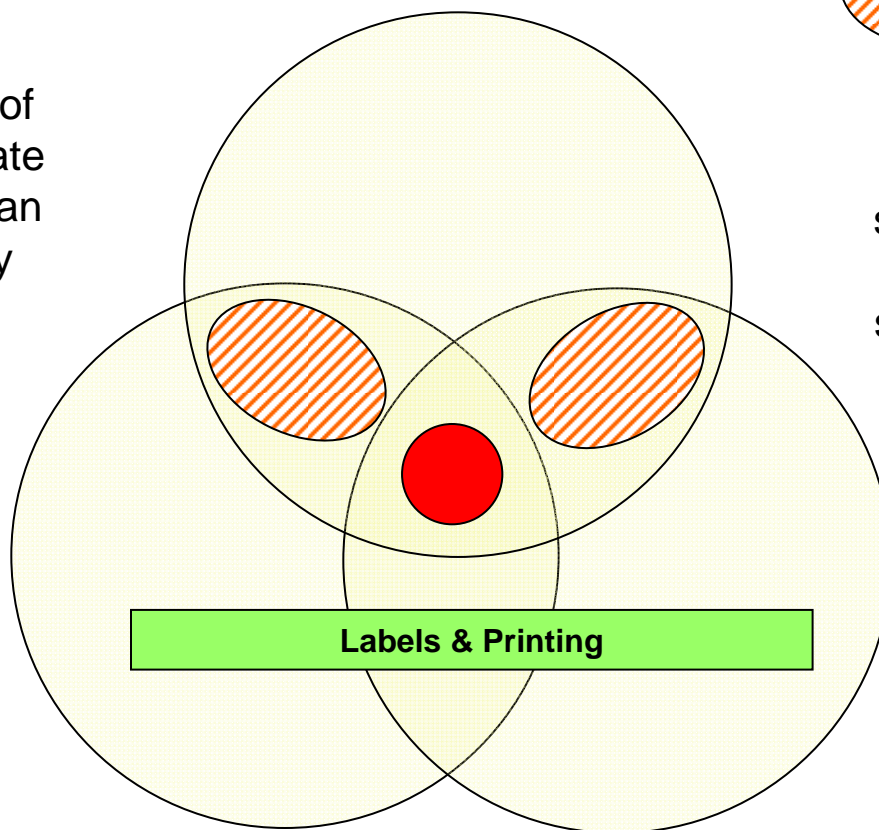
## Permanence

(Chemical/Temp/UV/Abrasion)



**TherMark  
Opportunities**

Where combination of permanence and/or substrate / mark quality are important and other solutions may not be viable



**Labels & Printing**


## Contrast & Resolution

(Readability / coding / branding / instructions / warnings etc.)

## Substrate Mark-ability & Integrity

(Non-ferrous metals / alloys / plastics / plated surfaces / glass & ceramic etc.)

# TherMark vs. Other Marking Methods

Value Proposition 0=Low 9=High	Stamping / Engraving	Pad/Screen Printing	Dot Peen / Pin Stamping	Direct Laser marking	
High Contrast	3	9	3	6	9
High Resolution	3	7	3	9	9
Permanence	9	5	9	8	9
Variable Data	0	0	9	9	9
Abrasion Resistance	9	3	9	5	9
Variety of Substrates	5	8	5	4	8
Chemical Resistance	9	3	9	6	9
Temperature resistance	9	3	9	6	9
Marking Speed	7	8	7	9	7
Available Colors	0	9	0	1	6
Equipment Cost	8	7	6	4	5
Overall Cost per Mark	7	5	7	7	5
Potential for Logo/Decoration	1	9	1	5	7
Overall Value "In-use"	70	76	77	79	101

# TherMark Versus Direct Laser Marking


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TherMark is a complementary product...

- Facilitates the use of lasers on materials that previously could not be marked; “get more from your laser”.
  - Aluminum, gold, silver, chrome etc.
  - Particularly relevant for lower powered inexpensive CO2 lasers
- Does not damage or change substrate
  - Important for plated surfaces and other sensitive applications
- Can deliver darker, high-contrast marks in a shorter time
  - But requires materials, application & cleaning

# TherMark vs. Direct Laser Marking

- Table shows ability to create black marks on common substrates

Equipment/ Method Type	Common Metals												Non-metals / Plastics						
	Stainless Steel	Aluminum	Anodized Aluminum	Chromium	Nickel	Brass	Titanium	Magnesium	Zinc	Gold	Silver	Copper	Ceramic	Glass	Nylon	Acrylic	ABS	PVC	Polycarbonate
<b>Direct Mark with Solid State Laser</b> YAG, Fiber Vanadate etc. (Wavelength 1064nm)	Y	Y	N	N	N	Y/N	Y/N	N	N	N	N	N	N	N	N				Y
<b>Direct Mark with CO2 Gas Laser</b> (Wavelength 9-11 μm)	N	N	Y/N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N		Y
 <b>THERMARK</b> laser marking technology	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	

- In some cases **contrast** marks can be achieved by direct laser marking on some of the substrates listed. This normally involves using high power (>40W) and ablating then burning the substrate rather than the carbon migration that is typically seen on steels. These marks tend to be dark brown rather than black and typically have less resolution and contrast, as well as altering the substrate.
- A CO2 laser can also produce frosted “gray/white” marks on glass through the process of micro-fracturing, which is unacceptable in many applications.

# Examples of Contributing Factors

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- Application:  
Optical projection components
- Why TherMark?
  - Ability to mark readable barcode on silver plated ceramic that can withstand 450°C
  - Substrate / Temperature
  - The only viable solution



# Examples of Contributing Factors

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- Application:  
Military battery cases
- Why TherMark?
  - Ability to make chemically resistant permanent black mark on white nylon case
  - Substrate / Permanence
  - The only viable solution





# Products and Capabilities

# Current Product Capabilities

Material	Black	White	Red	Green	Blue	Yellow	Bronze
<b>Metal</b>	Yes Liquid / Aero / Tape <i>Mylar HS Tape June</i>	No, R & D	No, R & D	No, R & D	No, R & D	No, R & D	No, R & D
<b>Ceramic</b>	Yes Liquid / Aero <i>Mylar HS Tape June</i>	Yes Liquid	Yes Liquid	Yes Liquid	Yes Liquid	Yes Liquid	Yes Liquid
<b>Glass</b> (YAG or Fiber Only)	Yes Liquid / Aero <i>Mylar HS Tape June</i>	Yes Liquid	Yes Liquid	Yes Liquid	Yes Liquid	Yes Liquid	Yes Liquid
<b>Plastic</b>	Yes / No Depends on Plastic	No, Tape in R & D 6-12 Months	No, Tape in R & D 6-12 Months	No, Tape in R & D 6-12 Months	No, Tape in R & D 6-12 Months	No, Tape in R & D 6-12 Months	No

- Industrial focus is on black marks for virtually any substrate
- Current color focus is for glass & ceramics
- When dealing with plastics, consult TherMark

# TherMark Laser Marking Materials

- All water-based products re-branded from CerMark™ to TherMark
- Packaging redesigned to reflect TherMark brand
- Products available in Liquid, Aerosol & Tape supply forms\*

\* Depending on product



# Key Products

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- **LMM14**
  - black, general purpose for metals
  - fast drying
  - water based, non-hazardous
  - very easy wash-off
  - aerosol, liquid
- **LMC6044P (and all LMC's)**
  - black, general purpose for glass/ceramic (and colors)
  - fast drying
  - water based, non-hazardous
  - liquid
- **LMM6000 (aka 'CerMark™')**
  - black, general purpose for metals
  - fast drying
  - ethanol based
  - hardener for storage/shipping before lasing
  - aerosol, liquid
- **LMM6018.LF Tape**
  - black, general purpose for metals, works on anodized metals
  - ultimate convenience
  - adhere to marking area, laser and peel off: leaving permanent mark behind

# TherMark vs. CerMark™ Products

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- Water-based
- Dries as powder
- 2 digit codes (LMM14, LMC12, etc.)
- Tapes
- Branded TherMark



- Made by Ferro under license
- Solvent based
- Dries hard
- 4 digit codes (LMM6000, etc)
- Branded CerMark™

TherMark sells both product lines depending on application specifics



# Business Focus

# Primary Focus - Industrial

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- Black marks on metal, ceramic & glass
- Volume driven industrial applications
- Batch and in-line manufacturing
- Focus on directly engaging these customers



# Secondary Focus - Awards

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- Low volume decorative applications
- Color on ceramic and glass
- Trophy shops
- Market is serviced by specialty distribution





# Using TherMark

# Application - Quick and Easy

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Spray



Laser Mark



Rinse

# General Usage Instructions

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1. Ensure part is clean from oil and coatings (lacquer, etc.)
2. Apply an even coating of LMM or LMC onto part (1 mil for LMM to 3 mils for LMC).
3. Allow to dry (typically 1-2 minutes or faster with forced air/heat)
4. Laser mark
5. Wipe off or wash off.

# Integration with Industrial Processes

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- Spraying
  - Liquid materials can be diluted and used with spray valves and guns
- Print Formulations
  - Material can be integrated with in-line pad or screen printing applications
- Tapes
  - Improve consistency of application
  - Ideal solution for high speed applications

# Product Availability

- Aerosol
  - 6 Oz, Black
- Liquid
  - Various sizes all colors
- Tapes
  - Paper backed, Black





Support from TherMark

# TherMark – Who To Call

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- Dave Labowitz  
Director of New Business Development  
323-344-9500 x106 office, 610-529-0388 mobile
- Howard Rupprecht  
Director of Sales and Marketing  
323-344-9500 x103 office, 650-305-1834 mobile
- Lori Keffalas  
Operations & Technical Support, East – PA  
323-344-9500 x105
- Joel Assaraf  
President/CEO  
323-344-9500 x102

323-344-9500 (main)  
first.last@thermark.com

# Applications Lab at TherMark HQ

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- 2 lasers (CO<sub>2</sub>, Fiber)
- Proof of concept jobs (metals, glass/ceramic)
- Ability to mark samples from your customers and help develop a usable process

# Sales Toolkit

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- TherMark Brochure
- Web site [www.thermark.com](http://www.thermark.com)
- Case Studies
- White Papers
- Technical Data Sheets
- MSDS
- Photo library
- Logos/graphics for web



# Target Market Segments

# Industries Served

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- Aerospace
- Automotive
- Medical devices
- Instrumentation
- Tools and machinery
- Sanitary ware
- Design and décor
- Awards and recognition

# Typical Drivers

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- Unique identification (UID), 2-D matrix, bar code
- Traceability
- Serialization
- Authentication
- Security ID
- Logos
- Custom design
- Decoration
- Personalization

# Known Sweet Spots

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- Stainless steel home appliance
  - Dynamic Cooking Systems
- Automotive aftermarket
  - Tube Solutions
- Hand-held surgical tools
  - Applied Medical
- Tools and machinery
  - Snap-On, Sturtevant Richmond
- Knives & cutlery
  - Cabelas, Stonebridge Collection

# Kitchen Appliances

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Brand marks &  
safety warnings on  
stainless steel



Value Proposition:

Improved contrast, better resistance  
to UV and chemicals. No substrate  
damage

# Automotive

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2-D matrix on  
aluminum  
transmission  
cooling system



Logos & marks on  
aftermarket parts

Value Proposition:

Improved contrast, hard to mark  
materials (Al & Chrome plating)

# Manufacturing & Industrial



LMM-14 on stainless steel tube connector



Black marks on a variety of substrates

# Medical Devices



Value Proposition:

Permanence on hard to mark surfaces with no substrate damage

LMM-14 on surgical stainless steel

# Military and Aerospace

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Marks survived extended trials in space with NASA



Boeing C-17 ground support UID

Value Proposition:

Permanence on hard to mark surfaces with no substrate damage

# US Army Depot Test – UID Tags



Mark survived shot-peen and heat treat test.  
The metal bent, yet the mark was still readable.

# Some Industrial Customers...

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