SPI COATINGS
PROVEN PERFORMANCE • REAL WORLD SOLUTIONS

NASA's 2024 Spinoff Magazine
SUPER THERM®

Edition 01/29/2024

NASA Technology Transfer Program

The 35-year history of SPI Coatings' development of SUPER THERM® is prominently featured in the latest edition of the NASA 2024 Spinoff Magazine.

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Website: www.spicoatings.com Email: sales@spicoatings.com

Super Insulation Requires Super Materials

Engineers at Marshall Space Flight Center have experience in testing spacecraft components against extreme temperatures, like the heat shield from the Orion spacecraft. The makers of Super Therm recognized this and reached out to the center for help. *Credit: NASA*

Super Therm has been applied in several places, including handrails on the Hoover Dam Bypass Bridge over the Colorado River. The selection of its ceramic and polymeric materials was assisted by NASA scientists. *Credit: Superior Products International II LLC*

The thermal protection system on the outside of the space shuttle included hundreds of ceramic tiles custom made for the orbiter. These reflected heat off the shuttle's outside surface during atmospheric re-entry and were an inspiration for the ceramic ingredients in Super Therm. *Credit: NASA*

NASA researchers helped create an insulation coating that blocks heat and sunlight

A summer day can be no picnic.

In addition to the outdoor heat and humidity, the direct sunlight beats indiscriminately on everything. Without proper insulation, a metal-roofed building can quickly feel like an oven.

In the late 1980s, Joseph Pritchett was developing an insulation coating in the U.S. Sun Belt and learned that not all his customers were satisfied with the options available at the time, so he thought he'd develop his own product. He knew NASA had experience in thermal testing, particularly in the realm of ceramics, which have several uses for the agency. Ceramics' heat-resistant properties make them excellent materials for spacecraft re-entry shields, and their durability is perfect for airplane components. However, as Pritchett later discovered, not all ceramic compounds can work in a coating that's applied wet and blended with paint. He had to find the right ceramic, and he thought by infusing paints with both insulating ceramic compounds and tough, resilient polymers, he could devise a coating insulation with the best features of both.

Through the Technology Transfer Office at NASA's Marshall Space Flight Center in Huntsville, Alabama, Pritchett contacted the center's materials lab. The facility had many ways to test heat-resistant materials, such as a thermal vacuum chamber that simulates the extreme temperature swings in space and a thermomechanical analyzer that measures how a sample expands under heating. When he asked researchers there for compounds that could help him, the scientists provided a list of possible ceramics. When none of those worked in a coating, the Marshall engineers widened their search and came back to Pritchett with more ceramic compounds.

Over a period of six years, Pritchett tested every compound on the lists NASA provided, whittling down the potential compounds until he found the perfect insulation. Pritchett founded Superior Products International II Inc. of Shawnee, Kansas, in 1995. The product, dubbed Super Therm, is a composite of both ceramic and polymeric materials. The ceramic acts as the primary heat reflector and heat-blocking insulator, while the polymer is more of a heat- and environmental-resistant binding agent. In 2011, when tested by the Oak Ridge National Lab for a pilot program for cooling low-income housing, it was confirmed that Pritchett's product would work as suggested and save energy when cooling homes.

Pritchett said the engineers at Marshall played a pivotal role in Super Therm's development, as their knowledge was key to finding the right ceramic material. In addition to building insulation, the material has been used in industrial applications, such as keeping equipment like tanks and pumps cool on oil rigs. Pritchett said other insulation providers have only recently started looking into the same material components to improve their products, but he's grateful Super Therm had the head start.

"It is now a source of accomplishment that I was able to work with NASA to get a start on the study of ceramic compounds when all the others are just now doing it," Pritchett said. "It gives us a 30-year head start on the study of what works and what does not work."

This NASA magazine highlights the extensive collaboration between NASA and SPI Coatings showcasing groundbreaking technological advancements all these years later. There are products that claim an association with NASA; but the **only insulation coating** with an established direct relationship to NASA is SUPER THERM®.

NASA TECHNOLOGY TRANSFER PROGRAM

NASA researchers helped create an insulation coating that blocks heat and sunlight.

When developing a new coating to protect buildings from heat buildup, SPI Coatings (Superior Products International II, Inc.) of Shawnee, Kansas reached out to the experts at Marshall Space Flight Center's materials lab for assistance in finding ceramic compounds that could be incorporated into a heat-resistant spray insulation.

SUPER THERM® has been applied in several places, including handrails on the Hoover Dam Bypass Bridge over the Colorado River. The selection of the ceramic and polymeric materials in SUPER THERM® was assisted by NASA scientists. Credit: SPI Coatings.

The thermal protection system on the outside of the space shuttle included hundreds of ceramic tiles custom made for the orbiter. These tiles reflect and repel heat away from the shuttle's outside surface during atmospheric re-entry and were an inspiration for the ceramic ingredients in SUPER THERM®. Credit: NASA

Engineers at Marshall Space Flight Center have experience in testing spacecraft components against extreme temperatures, like the heat shield from the Orion spacecraft. The inventor of SUPER THERM® recognized this expertise and reached out to the engineers at the Center for help. Credit: NASA

J.E. Pritchett, President at SPI Coatings

Each ceramic compound was tested one by one to find the select few that actually worked “when” blended into a coating formula. That single step of individual testing takes time and effort having little to do with “throwing a lot of money at it” which has been the statement of large firms thinking the answers are in the web somewhere. AI or the web “only knows” what has been published and presented for public view. I have not published my findings nor will I. Therefore, AI and the web remain in the dark on “individual testing of over 4,000 ceramic compounds” finding the correct compounds that actually work. I checked AI using the web asking specific questions that I know to ask to see if AI has this understanding and it does not. I find it amusing how AI will identify a compound as the “one” generally, then specifically state it cannot work.


TECHNOLOGY
2005
DISCOVER
Tomorrow's
HOTTEST
Technologies
TODAY
The sixth
national
technology
transfer
conference &
exhibition
October 24-26,
1995
McCormick Place
Convention
Center
Chicago, IL

...is Research Center
...os Alamos National Laboratory
Machida Inc.
Marshall Space Flight Center
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Thermo Electron Tecomet
Thiokol Corp.
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Transcience Associates
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Triton Systems Inc.
U.S. Air Force Science & Technology
U.S. Army -- Dept. of Army Research Labs
U.S. Army Armament Research Development & Engineering Center
U.S. Army Combat Systems Test Activity
U.S. Army TARDEC "National Automotive Center"
U.S. Army -- ATC Aberdeen Test Center
U.S. Dept. of Agriculture, Agricultural Research Service
U.S. Dept. of Energy, Office of Technology Utilization
U.S. Dept. of Energy Kansas City Plant
U.S. Dept. of Energy OTD/Triodyne
U.S. Dept. of Energy Office of Clean Coal Technology
U.S. Dept. of Interior
U.S. Navy Best Manufacturing Practices/Production
U.S. Navy SBIR Program
Unitech Research
University of Wisconsin-Madison
Van Nostrand Reinhold
Vector Fields Inc.
Virtual Worlds Inc.
Westinghouse Savannah River Company
XCORP

Is your organization missing from this list? Call Wayne Pierce at (212) 490-3999 to find out how you can exhibit at T2005. (Hurry! Space is limited.)

Exhibition Hours
Oct. 24: 10:00 am to 4:00 pm
Oct. 25: 10:00 am to 4:00 pm
Oct. 26: 10:00 am to 3:00 pm

NASA Rolls Out Its Best New Technologies For Transfer

Centerpiece of the T2005 exhibits hall, NASA's 5000+ square-foot pavilion presents an unparalleled opportunity to see the agency's top technologies & meet its leading researchers & tech transfer agents – all in one place, at one time. Dozens of red-hot inventions from NASA's R&D centers will be demonstrated & displayed, including:

- Active Pixel Sensor -- a revolutionary imaging sensor produced at Jet Propulsion Lab (JPL) that shrinks cameras to the size of a computer chip
- Methanol Liquid Feed Fuel Cell – offering enormous potential for the energy industry, this novel solid-state energy storage device (also from JPL) is always operational–unlike batteries–& environmentally friendly
- Sensor Skin -- from Kennedy Space Center, an electronic "skin" that enables robots to sense their environments & handle extremely delicate tasks
- The Simulation Virtual Machine – a real-time simulation system developed at Johnson Space Center for space shuttle & airline pilot training, now available for commercial use in entertainment, mass transit, & other industries
- Capillary Pumped Loops -- from NASA Goddard, a technology for spacecraft thermal control that can be applied to heat or cool specific parts of the human body without an external power source...a boon for the sporting goods industry, firefighters, & medical device manufacturers

- Self-Nulling Probe – a low-cost, portable, nondestructive evaluation tool developed at Langley Research Center that detects cracks, corrosion, & coating thickness in metallic objects
- Ice Thickness Gauge – also from NASA Langley, a breakthrough technique for measuring & monitoring ice buildup (& in some cases initiating deicing) on aircraft, ships, & power lines

4

J.E. Pritchett talks about SUPER THERM® in the 3:00pm speaker slot at the NASA New Technologies Conference

– albeit with an arduous development phase. An advantageous switching to "open" in a silver epoxy preform promises to benefit airplanes, cars, measurement instruments, & home electronics.

3:00 SUPER THERM Ceramic Coating Insulation

JE Pritchett, President, Superior Products Intl.

A water-borne coating spun off from NASA research has proven an outstanding insulator in harsh weathering conditions. Mr. Pritchett will outline how he worked with NASA to commercialize this technology & describe successful applications worldwide.

Medical Technology (part 1)

Moderator: Paul Bennett, Manager, Technical Marketing, Virtual Prototypes Inc.

2:00 Ultrabright X-ray Light Sources for Biological Microimaging

Charles Rhodes, Laboratory for Atomic, Molecular, & Radiation Physics, University of Illinois at Chicago

A revolutionary x-ray imaging system could shed important light on how the body works on the cellular level. The laser-based system can capture 3D pictures of the molecular anatomy of living cells & tissues.

2:30 CCD-Based Mosaic Digital Mammography

James McAdoo, Electronics Engineer, NASA Langley Research Center

An all-digital mammography imager achieves unprecedented spatial resolution, providing full-breast coverage. Mr. McAdoo will explain the technology's advantages & its (significant) market potential.

3:00 High-Precision Calibration of Body Composition Measurements

Dr. Ruimei Ma, Associate Scientist, Brookhaven National Laboratory

Brookhaven's in vivo neutron activation (IVNA) facilities offer a rapid, reliable, & relatively inexpensive way to gauge body composition for research on aging, malnutrition, & diseases such as AIDS & osteoporosis. With absolute precision, they can calibrate instruments for clinical body composition studies using IVNA analysis.

3:45 pm (to 5:15)

Leading-Edge Technologies
Concurrent Symposia

Display/Imaging Technologies

Moderator: Robert Doornick, President & CEO, International Robotics Inc.

3:45 Laser-Based 3D Volumetric Display System

Parviz Soltan, Scientist, Naval Command, Control, & Ocean Surveillance Center

A Navy-developed 3D display shows exciting promise for dual-use applications in air traffic control, medical imaging, & television. (A 3D TV would allow the home viewer to watch from all sides, without the special glasses that lim picture viewing.) It employs lasers focused on the su spinning double helix to generate points of light in thereby forming 3D images of the data presented.

4:15 Augmented Virtual Vision Head-Mounted Displays

Michael Ohanian, Marketing Manager, Virtual Vision Inc.

Boeing, Carnegie Mellon, & Virtual Vision have teamed to produce lightweight head-mounted displays for the industrial maintenance market. They project video information such as manuals & mechanical drawings to the wearer, whose hands remain free & surroundings stay in view at all times.

4:45 Diver Heads-Up Display

Dennis Gallagher, Naval Coastal Systems Station

A compact, mask-worn display module delivers color NTC video, text, & graphics to divers at depths approaching 100FSW. Underwater cameras & sonar, navigation & life support systems, & undersea video classrooms are just some of the areas with immediate commercial potential.

Microelectronics (part 1)

Moderator: Yahong Jin, Senior Optical Engineer, Standard Intl. Inc.

3:45 A Novel Method for Fabricating Flexible Printed Circuits

Nancy Kruse, NASA Langley Research Center

A self-bonding soluble polyimide developed at NASA Langley is the key to producing completely adhesive-free flexible circuits. Benefits: reduced material & processing costs & lighter end-weight circuits with increased flexibility.

4:15 Aluminum Nitride in Microelectronic Packaging

Stephen Elliott, Carborundum Co.

The evolving "miracle material" called aluminum nitride (AlN) can dramatically improve chip & component performance through improved thermal management, & enable the U.S. to leapfrog competitors in the global microelectronics market. Carborundum is working with ARPA and the Air Force to develop low-cost AlN packaging for applications ranging from automobiles to wireless telephones to military equipment.

National Aeronautics and Space Administration

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Huntsville, Alabama 35812
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Brett Cornwell
E.D. Manager

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MARSHALL SPACE FLIGHT CENTER

1-800-872-6272
C.F. Key, Deputy Director
Materials & Processes Lab.

1989

Civil - Building Systems

SUPER THERM - CERAMIC PAINT INSULATION

THE NEED

SUPER THERM is the result of years of research and development into Thermal Conductivity in cooperation with the Marshall Space Center, division of NASA. SUPER THERM can control heat exchange between the inside and outside of a building. By implementing SUPER THERM, the effectiveness of the insulative ability will increase because when SUPER THERM is applied to the exterior side of the wall, it repels exterior heat and moisture to prevent it from entering the wall. At the same time, it helps to control the loss of heat from the inside during the winter months by bouncing back the heat waves travelling from the interior heated room through the wall structure escaping to the outside.

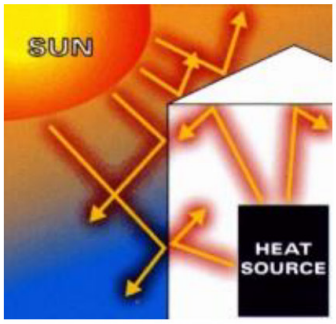

FIGURE 1 SUPER THERM BARRIER MAINTAINS HEAT ON THE SURFACE SIDE OF THE BUILDING - WILL NOT ALLOW PENETRATION

THE TECHNOLOGY

SUPER THERM is a combination of high-performance acrylic resins in water, which contain no cosolvents and will dry by evaporation. SUPER THERM has two reflective ceramics to reflect sunlight and radiant heat while the third ceramic compound works to stop heat and/or conduction through the coating film. The combination of acrylics provide elasticity and toughness with the urethane providing the binding for the acrylics and compound while also providing a moisture barrier.

The SUPER THERM is perfect for interior or exterior walls of wood, metal, concrete, standard wallboard, stone or stucco, and for roofing surfaces of steel, rubber, tar or asphalt shingles.

http://dx.doi.org/10.5703/1288284315712

FIGURE 2 SUPER THERM APPLICATION (METAL ROOF/ CONCRETE WALLS/ SURFACE OF STORAGE TANKS)

Other specific uses of SUPER THERM are for:

- Industrial / chemical plants.
- Oil and gas storage tanks / pipeline
- Interior and exterior walls on building / residential, commercial, warehousing
- Roofing on any structure
- Swimming pool decking or concrete.
- Freezers / refrigeration units / trucks / trains / boats.
- Air conditioning unit outer casings, evaporative coolers.
- Mobile homes / motor homes / cars / trucks
- Poultry, cattle -- all animal shelters

THE BENEFITS

- SUPER THERM is water-based. This offers tremendous advantages to the user of the product.
- SUPER THERM does not require extra effort work in clean-up of equipment and allows equipment longer life.
- The product is non-toxic, non-flammable, will not smoke and offers--due to the ceramics--some sound-proofing. It has been fire-tested with '0' flame and smoke results.
- SUPER THERM cures out completely in one week to an extremely tough, durable, non-yellowing, water-resistant coating that also provides flexibility an ultra-violet stability.
- Clean-up with soap and water, or just water by itself is sufficient.
- USDA-approved for use in and around food preparation.

STATUS

SUPER THERM is awarded NASA's highest rating as non-toxic, passed flammability tests to receive an A-rating (highest non-flammable rating), and NASA is currently considering SUPER THERM for application to the external tanks of The Shuttle and the launch pad. One of the most successful applications of SUPER THERM is in the treatment of roofs and walls of commercial and residential structures as a barrier against heat and cold. Over the past few years SUPER THERM has been well proven in a variety of countries, such

http://dx.doi.org/10.5703/1288284315712

as Australia, Canada, Colombia, Japan, United Arab Emirates, and USA. SUPER THERM is registered as THERMSEAL under Intercoat..

BARRIERS

SUPER THERM was designed and its technology is built upon providing the insulation effectiveness on a single coat, with minimum of 7 dry mils or 200 microns thickness. Two or three applications or coats are required if there is an intent on overcoating SUPER THERM with another paint product, which is usually a particular color over the top of the SUPER THERM for decoration. The extra thickness is required because the colored paint applied over the top of the SUPER THERM will catch and hold heat.

POINTS OF CONTACT

Jerry Pope, Superior Products International II Inc.
Tel: (816) 241 - 1976, Fax: (816) 241 - 1772.
Superior Products North America,
Tel: (888) 545- 4443, Email: info@superiorproductsusa.com

REFERENCES

1. Insulating with SUPER THERM, SUPER THERM Catalog, Superior Products International II Inc. SUPER THERM Solutions, Technical Information, Superior Products International II Inc.
2. Thermophysical Properties of SUPER THERM Coating, Thermophysical Properties Research Laboratory, Purdue University Research Park.
3. Super Therm: The Last Word in Insulating Protection, Freedom Fire Safety Ltd.

REVIEWERS

Peer reviewed as an emerging construction technology

DISCLAIMER

Purdue University does not endorse this technology or represents that the information presented can be relied upon without further investigation.

PUBLISHER

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National Aeronautics and
Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of: LA20

Dear Partner in Technology Transfer:

It is a pleasure to provide you with this information packet that outlines NASA's Technology Utilization Program and explains the technical capabilities at the Marshall Space Flight Center. We hope that this information on NASA and other federal technology resources will help you in your businesses and in assisting others in your state.

We look forward to meeting you and to visiting your manufacturing facility or economic development agency. Hopefully, we will be able to make a match between your technology needs and the significant resources that are available here at Marshall, other NASA Centers, and Federal laboratories.

Sincerely,

Kenneth R. Fernandez
Manager
Technology Utilization Office

J.E. Pritchett

SUPERIOR PRODUCTS

2361 Saxwood
Box 2357
Salina, KS 67401
Phone: 913-823-1978
Primary Fax:
913-823-1978
Secondary Fax:
913-827-3506

• MANUFACTURING
• DISTRIBUTION
• CONSULTANTS

March 23, 1990

George C. Marshall Space Flight Center
Mail Stop AT 01
Huntsville, Alabama 35812

ATTN: Ismail Akbay
John Richards

Dear Mr. Akbay,

I had spoken to Mr. Steven Riddlebaugh at the Lewis Research Center this morning and he referred me to you. I spoke with Mr. Richards, and he suggested I write you as to my research needs.

For two years, I have been working with a urethane/acrylic water base insulating coating. I presently am using several powders that have reflective/insulation abilities. SUPER THERM is the name of my coating. S.T. has performed very well in Fire Tests and achieved 0 flame spread and smoke in tests.

What I am trying to accomplish is to find the right combination of insulating powder compounds that can be added to the formula that would increase its insulation ability and possibly increase its fire protection ability. Insulation is our #1 goal. I want 15 mil of this coating to out perform 12 inches of batt Fiberglass insulation or give a miniumum of a R-30 performance.

I really appreciate your taking time to review and help me with this project. SUPER THERM must remain flexibile and elastometric to be used for roofing.

Regards,

J.E. Pritchett
President/Owner

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812
AC(205)544-2121

NASA

1511

Reply to Attn of: AT01

MAY 29 1990

Mr. J. E. Pritchett
President, Superior Products
2361 Saxwood
Box 2357
Salina, KS 67401

Dear Mr. Pritchett:

In reply to your letter dated March 23, 1990, I have been informed that Roger Harwell of our Materials and Processes Laboratory telephoned you and discussed the insulating powder compounds that you could add to your formula for SUPER THERM to increase its insulation ability.

Mr. Harwell suggested the following pigments be evaluated: SiO_2, ZrO_2, or SrO. Because of the thermal conductivity changes at high temperature (2000°), the pigment recommendations were SrO, ThO_2, TiO_2, and MgO. If the coating does not have to be white, then PBO (yellow) could be used to give a very low conductivity or Mn_3O_4 (black) could be used as second best.

We will dispose of the container of SUPER THERM that you sent.

Sincerely,

Ismail Akbay
Director, Technology Utilization Office

Ceramics Technology
Dr. Dennis Tucker
544-2685

MTL. Sourcing
Dr Richard Congo
544-2629

Ceramic Inorganic Chemicals
Milwaukee Wis. - Fisher Scientific
414-359-9800
SrO_{99} - STRONTIUM Oxide - +100 mesh
50 grams #35 99.5
200 " #65

Sales Rep.
Joan Hanson
Pauline - Secr.

ZrO_2 - ZIRCONIUM

ThO_2 Thorium Oxide 50 - $20
200 - $65

TiO_2 TITANIUM Oxide

MgO MAGNESIUM Oxide - 325

SiO_2 - Silicon Oxide
ZrO_2 - Zirconium Oxide
SrO -

Magnesi

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
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NASA

Reply to Attn of: EH34 (90-38)

MAY 2 2 1990

TO: AT01/Ismail Akbay

FROM: EH01/Paul H. Schuerer

SUBJECT: Insulating Coating, Inquiry of Superior Products

This memo is written in response to the enclosed memo dated April 3, 1990, concerning the special enclosed container of coating, SUPER THERM, provided by Mr. J. E. Pritcher, President of Superior Products.

Mr. Pritcher was seeking the right combination of insulating powder compounds to add to his formula to increase its insulation ability. Also enclosed is a copy of Test Results, Tech Sheets and Applications from Superior Products. Mr. Roger Harwell, ER41, contacted Mr. Pritcher to discuss the details of his formula and suggested that in order to develop a low temperature/low conductiviy coating, the following pigments be evaluated: SiO_2, ZrO_2, or SrO. Since, the order of thermal conductivity changes at high temperatures (2000°), the pigment recommendations were SrO, ThO_2, TiO_2 and MgO. If the coating does not have to be white, then PbO (yellow) could be used to give a very low conductivity or Mn_3O_4 (black) could be used as second best.

If anymore technical information is needed to make an assessment of the coating needs, Roger Harwell can be contacted at 544-2684.

Paul H. Schuerer
Director
Materials and Processes Laboratory

---- AT01----

3 Enclosures

MAY 93 cc:
EH01/Ms. Curtis
EH31/Mr. McIntosh

SUPER THERM® DEVELOPMENT
HEAT LOAD VERSUS STANDARD INSULATION

In the late part of the 1980's, the inventor (J.E. Pritchett) began working with the reflective coating companies that made "NASA ceramic paints". He learned that the formulas used for these reflective paints were not made from NASA technology and were only good for light reflection. When the coatings became dirty or tarnished, the coatings did not reflect solar heat.

In 1987-88, J.E. Pritchett decided to contact NASA directly to ask the NASA engineers what kind of ceramics to use to make an insulation coating. The NASA engineers at the Marshall Space Center told Mr. Pritchett that they had never developed a ceramic insulation paint and that the marketing materials used by the reflective companies that they used "NASA Technology" was not true. Mr. Pritchett then asked the engineers what types of ceramics they would recommend using in a coating that could provide insulation. The engineers worked with Mr. Pritchett for some time to choose the particular ceramics in the engineering books that would be the best in blocking solar heat. Mr. Pritchett tested all the ceramics that were suggested by the NASA engineers and determined that none of the ceramics were successful in blocking solar heat.

The NASA engineers then helped Mr. Pritchett by directing him to ceramic suppliers around the world so that he could contact them to obtain ceramic samples and begin a long research and development period using a "trial-and-error" method of testing each individual ceramic compound to see if it could block and repel solar heat. During the development processes between 1988 and 1992, SUPER THERM® was created using three ceramic compounds to meet the needs of heavy industrial plants and petrochemical areas to offer insulation for pipes, tanks, and facilities. The first formula of SUPER THERM® was sold to industrial users in 1989. By 1992, Mr. Pritchett had tested over 700 compounds in a continuing effort to determine which additional ceramic compounds might be more effective in blocking solar heat waves. The important point of this testing was to find most effective ceramic compounds that could continue to block and reflect solar heat waves even after the coating became dirty and less white in color.

In this process of investigation and research, Mr. Pritchett learned that density, crystalline structure, size, type of compound, and method of the compound processing were the most important characteristics that made the ceramic compound effective in blocking solar heat waves. The density of each compound was tested, and the lower density compounds would not absorb the heat. Heat can easily absorb into and make metal very hot, but paper can absorb heat and not become hot. The ceramic compounds in SUPER THERM® are 50 times less dense than paper and therefore, solar heat cannot load or absorb into these ceramics. Crystalline structure is the design of the ceramic compound. This becomes important when the structure is made to repel heat movement over the compound and to throw off the heat from the surface. The size is very important to be able to block the solar radiation wave as it hits the coating surface. In testing performed by German engineers, a study was made to determine what materials and at what size are most effective in blocking Infrared

radiation (long wave) and visual light (short-wave) radiation to block the heat wave from entering or passing through the coating.

Infrared radiation was tested and determined to represent 57% of the heat from solar radiation. 40% of the heat was visual light (light spectrum) that heats up the surface and then the surface conducts heat into the building. Finally, 3% of the heat comes from UV which is not significant. SUPER THERM® has been tested to block 99.5% of long wave radiation and 92% of short-wave radiation. The ceramic compounds naturally block UV. To successfully block heat waves and heat build-up on a surface, the chosen ceramic compounds perform the functions of blocking heat waves from passing through the coating and other ceramic compounds will block the heat that would normally build up on the surface and then transfer by conduction. Type of compound and how it is processed to resist heat loading is critical.

From 1989-2023, a total of 4,000 + compounds have been tested to find which compounds can improve the existing insulation coatings or develop new insulation or high heat coatings that can provide answers to insulation problems in industrial environments. In many areas of the industrial complexes or types of operations, fiberglass, or rock wool, cannot work well and using concrete mixtures is not a good solution. The high temperature coatings developed can be sprayed into place with few man hours, are easy to apply, safe to use for workers and the environment, and are extremely effective.

A tremendous amount of discovery and testing has been performed over a 35-year period to determine the best selection of ceramic compounds to provide a total insulation program. From the research used to develop the radiation heat blocking ceramic coating, additional research has continued on ceramic compounds and the combinations of these compounds to find the right balance of ceramics to build new and improved coatings for high heat insulation for hot pipes and furnace walls and ceiling uses as well as fire controls for structural steel, apartments, housing and industry to protect all building materials used in construction.

The research and development process was understood early to be the only way to fully understand a compound and how it could or would act when mixed into a resin system with water and other raw materials. There are no books that contain a study of ceramic compounds and how each compound functions or fails in all circumstances of a wet environment or mixed into a formula. Therefore, the research and development process is a daily, weekly, monthly and yearly effort that continues on any and all new compounds brought to our attention. The search is ongoing and will continue to discover the next major breakthrough in heat control.

Consider the thickness factor—

Comparing SUPER THERM® to all the thick insulation materials designed to absorb and slow down the conduction of heat is totally outdated. Everyone knows that the original insulation materials have been thick materials. The reason is simple: the heat is loaded into a surface and then the materials had to be thick to provide resistance to the time it would take for all this heat to transfer or conduct through the materials to the other side. This conduction method of insulation is gauged by the "R" or "K" value, which is a

simple measure of this heat absorption and transfer through the materials. It is a measurement of the rate of heat transfer.

All the marketing, all the education in the Universities, and all the principles of insulation were based upon thickness to buy as much time as possible from initial heat load to transfer through the material.

All these thick materials are designed for slowing down conduction - fiberglass, rock wool, foam, and other materials. These materials accept HEAT LOAD on the surface which they are trying to work under or next to. All these materials are based on "after-the-fact" heat load and are doing nothing more than trying to manage the 100% heat load that they cannot fully control.

Now consider SUPER THERM®. It is not thick and, therefore, how could it be effective in conductive resistance? The interesting part of SUPER THERM® is that it works to control two recognized heat transfer modes – radiation and conduction. Since it resists heat load and has a high emissivity, SUPER THERM® uses convective heat to balance the interior room temperatures.

NOTE: Convection inside a building moves heat from one location (hot area) to another location (cold area). It works to make the room temperature uniform. The surface properties have little to do with the heat transfer across the wall, i.e. from inside to outside. There is heat load into the wall, then conduction is the mode of transfer to the cool side.

Thick materials were designed to address only conduction, and actually ignore radiation, which is the most dominant heat transfer mode under the sun.

SUPER THERM® works to block the initial radiation causing the HEAT LOAD. By blocking 95% of the initial heat load, there is only 5% of heat "available for transfer", proving that SUPER THERM® is effective even without the conventional standards of thickness. In addition, SUPER THERM® provides a barrier against moisture and air movement. It has been studied and proven that a large percentage of heat loss or gain is due to moisture load in the substrate as well as air leakage causing the heat to load quickly and travel through the structure. SUPER THERM® seals the substrate and blocks moisture absorption and air leakage.

If you allow only a 5% heat load onto a surface that is the target of insulation, you have only a 5% heat transfer that enters the substrate. Thick materials allow almost 100% of this heat load because their surface is not designed to block the heat load--they are designed to absorb heat and slowly allow it to transfer - such the "R" or "K" value measurements.

Radiation is not the only heat transfer that SUPER THERM® blocks. It blocks conduction as well. Blocking HEAT LOAD is the key to measuring insulation and SUPER THERM® provides the best in the market. It is based and established on all approved test standards.

Marketing and education need to understand the simple facts of insulation--if you block heat load, you control the amount of heat gain or loss.

Everyone understands the capability of repelling or reflecting heat gain on the exterior. The principle is the same for the interior, as SUPER THERM®'s ceramic blend resists the majority of heat load because the ceramic compounds do not have the density to

absorb and hold heat. What heat is absorbed into the coating is thrown back out of the coating to stabilize the heat and helps the convective heat movement between warm and cold areas stabilize quicker.

This is called EMISSIVITY, which is a test measurement of how much or fast a surface can unload the heat it does absorb. Emissivity is a property of a material, not a rate of heat transfer. The material covering the wall or ceiling would be the ceramic coating and therefore its' emissivity will equal the rating of the coated surface and not the substrate material. In this case, the emissivity is 0.91 in throwing heat off its' surface back to the room.

This is HEAT LOAD versus HEAT TRANSFER. SUPER THERM blocks heat load, which is the beginning of the heat loss or gain problem. All the thickness designed materials try to control the conduction of the initial heat load that they have no way of blocking. Therefore, the measurement of "R" or "K" relates to how quickly this heat load transfers.

The question becomes, do you want more thickness to overcome the rate of heat transfer and this thickness factor having to increase due to absorption of moisture (humidity) and air flow --or-- would you rather block the initial HEAT LOAD and stop this process from ever occurring while blocking moisture absorption and reducing air flow?

Expand the expectation for this coating from just being a heat control whether summer heat gain or winter heat lost to a more complete system coating that can not only be a moisture barrier, but a proven water barrier to a 60 mph wind driven rain, a sound barrier blocking up to 50% of the talking frequency sound transmission through walls (due to the same ceramics that cannot load heat), to a "0" fire spread with a Class A rating, to a mold/mildew blocker that helps to stop condensation, yet can breathe to avoid mold development.

Standard insulation materials are loaded between all the studs and joists leaving the studs and framing to load and transfer heat? When the fiber materials are pushed into place and compacted, do you think this reduces its' "R" factor -- yes it does and dramatically. A material schedule to be a R 19 at 6 inches is forced into a standard stud wall where the stud is 3 5/8". The material is pushed into place making it an average of 3" thickness. Since this is only effective based on thickness, you have a R 9.5 that was never R19. Since most homes in the US and abroad are 2X4 stud construction, they have never been in code. Therefore, basing insulation on R value is completely subjective as traditional insulation installed out of the lab and in the field cannot perform to its' marketed performance.

This is simply the reason for opening our minds to new technology that works as tested, proven, and marketed.

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