

# Advanced Materials for next generation energy storage

## Lithium Ion Battery and Fuel Cell Technology



# Manufacturing cutting edge materials to help our customers solve complex **thermal runaway** and **fire protection** challenges in lithium ion battery and fuel cell technology systems



Thermal Ceramics, a business of Morgan Advanced Materials has extensive experience working with customers all over the world to engineer, design and manufacture high performance insulation in operating environments from 932°F to 2912°F (500°C to 1600°C). We have a proven track record for helping customers to improve operational efficiency and respond to changing environmental pressures.

We harness the ingenuity, passion and expertise of our applications engineers to pursue increasingly advanced ceramic insulation solutions which sets us apart.

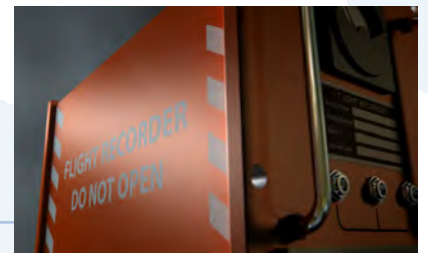


- Supply intelligently engineered insulation solutions to a wide variety of industries and market sectors
- Integrated approach, incorporating design, manufacture and installation

Thermal Ceramics is committed to expansive research and development ensuring that our products remain at the technical edge and continue to push boundaries.

## APPLICATION ENGINEERING EXPERIENCE

- Morgan's understanding of the materials science required to prevent the spread of thermal energy is demonstrated in our supply of the material surrounding FDR and CVR products in aerospace and rail which is designed to survive arduous mechanical, thermal and fire conditions
- We are the trusted supplier of materials for surrounding living quarters in offshore oil rigs, specifically designed to protect the structure to allow additional time for operators to escape from a fire



MIN-K® PRODUCTS ALLOW MANUFACTURERS TO MEET HARSH FIRE PROTECTION REQUIREMENTS AND SAFEGUARD ELECTRONICS IN CATASTROPHIC ENVIRONMENTS.



10,000 M<sup>2</sup> FIREMASTER® MARINE PLUS BLANKET INSTALLED FOR ONE HOUR FIRE PROTECTION OF EXTERNAL AND INTERNAL STRUCTURE

## MATERIAL SOLUTIONS

Extensive range of high temperature thermal insulation and fire protection products used to thermally manage battery and fuel cell technology systems.

- Custom engineered solution for your application, your company
- Multiple material formulations and compositions available
- Flexibility in design for your bespoke application
  - e.g. Solutions for cell-to-cell, pack-to-pack, whole systems
- Rapid development and prototyping capabilities
- Knowledge of battery industry and requirements for transportation, energy storage, and EVs
- Proven real-world experience

Thermal Ceramics features product and system solutions high temperature insulation Fiber and Microporous materials. These materials each offer unique thermal and fire protection characteristics to battery and fuel cell technology applications.

Our fiber products and systems can be manufactured into blankets, mats, papers, felts, flexible or rigid boards and shapes, textiles, mastics, monolithic modules, or fabricated into heat shields.



FIBER PRODUCTS

- AES fiber (Alkaline Earth Silicate fiber) with a Classification temperature up to 2372°F (1300°C)
- RCF fiber (Refractory Ceramic fiber) with a Classification temperature up to 2600°F (1426°C)
- PCW fiber (Polycrystalline fiber) with a Classification temperature of 2912°F (1600°C)

Features of these fiber grades:

- Exceptional insulating performance
- Excellent thermal shock resistance
- Low heat storage capacity

Our WDS<sup>®</sup> Microporous products are highly efficient thermal insulation solutions which are a composition of silica, fibers, and specially developed infrared opacifiers which reduce thermal transport processes by absorption and reflection of radiant heat.

Features of microporous products:

- Exceptional thermal efficiency
- Low weight with high compressive strength
- Vibration and pressure resistant

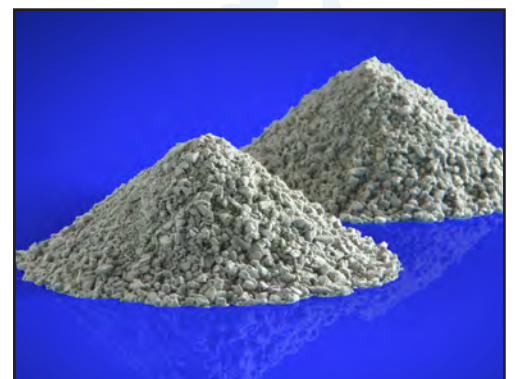
WDS is successfully used in SOFC or PAFC as cell insulation. It can withstand permanent temperatures of up to 1832°F (1000°C). Additionally, it can be incorporated into vacuum insulation with even lower thermal conductivity.

The main advantages of WDS are:

- Low thermal conductivity
- Absolute thermal shock resistance
- Inorganic granules ideal for the filling of voids and complex geometries



VACUUM SEALED MICROPOROUS



GRANULATE MICROPOROUS

## MORGAN ADVANCED MATERIALS



Morgan Advanced Materials is a global engineering company offering world-leading competencies in materials science, specialist manufacturing and applications engineering.

We focus our resources on the delivery of products that help our customers to solve technically challenging problems, enabling them to address global trends such as energy demand, advances in healthcare and environmental sustainability.

### What differentiates us?

Advanced material science and processing capabilities. Extensive applications engineering experience.

A strong history of innovation and reinvention. Consistent and reliable performance.

A truly global footprint. We find and invest in the best people.

For all enquiries, please contact our specialist offices:

#### Europe

Morgan Advanced Materials  
Morgan Drive  
Stourport-on-Severn, Worcestershire  
DY13 8DW United Kingdom

T +44 (0) 1299 872210  
F +44 (0) 1299 872218  
europesales@morganplc.com

#### North America

Morgan Advanced Materials  
P. O. Box 923  
Augusta, Georgia, 30903  
USA

T +1 (706) 796 4200  
F +1 (706) 796 4328  
nasales@morganplc.com

#### South America

Morgan Advanced Materials  
Avenida do Taboão 3265  
São Bernardo do Campo  
SP CEP 09656 000 Brasil

T +55 (21) 3305 7400  
F +55 (21) 2418 1205  
sasales@morganplc.com

#### Asia

Morgan Advanced Materials  
150 Kampong Ampat  
05-06A, KA Centre  
368324 Singapore

T +65 6595 0000  
F +65 6595 0005  
asiasales@morganplc.com

Thermal Ceramics is a business of Morgan Advanced Materials plc  
Quadrant, 55-57 High Street,  
Windsor, Berkshire, SL4 1LP United Kingdom

[www.morganthermalceramics.com](http://www.morganthermalceramics.com)  
[www.morganadvancedmaterials.com](http://www.morganadvancedmaterials.com)