TECMAN

ADVANCED MATERIAL ENGINEERS

GUIDE TO THERMAL MANAGEMENT
FOR BATTERY DEVELOPMENT

ADVANCED SOLUTIONS TO UNLOCK INNOVATION

TECMAN SPECIALITY MATERIALS LTD

THERMAL MANAGEMENT

www.tecmanuk.com

ISSUE NO.3

02

TECMAN
ADVANCED MATERIAL ENGINEERS

GUIDE TO

THERMAL MANAGEMENT FOR BATTERY DEVELOPMENT

This guide is written for Automotive OEMs and tier suppliers looking for the most effective thermal management solutions for battery development projects.

There are many different thermal management challenges in E-mobility. A common concern is that as EV battery capabilities increase so does the excess thermal energy, a detrimental by-product that can deplete the service life of the battery, reduce performance, and pose significant safety risk from thermal runaway events.

We provide thermal management solutions for our customers' battery systems projects through innovative engineered solutions and the intelligent application of advanced materials with thermodynamic and heat transfer properties.

Tecman has over 25 years' experience as a converter partner for automotive and wider manufacturing industries. Our vast industry and engineering knowledge, expertise in advanced materials and technologies enable solutions that have the potential to solve many of the thermal related challenges that battery design engineers face today, helping unlock superior performance and innovation.

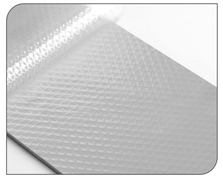
A GUIDE TO
MATERIALS & PRODUCTS

SPECIALIST THERMAL INSULATION MATERIALS

Ultra-lightweight insulation materials with the highest thermal insulation to weight value of any material.

BENEFITS

The most effective material for prevention of thermal propagation in a thermal runaway event.



THERMAL INTERFACE MATERIALS (TIM)

Liquid and pads used in Li-ion battery systems for transfer of thermal energy between cells, components and thermal management units.

BENEFITS

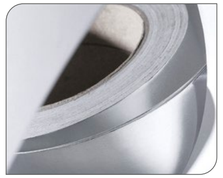
Advanced thermal transfer interface materials allowing multi-directional transfer of thermal energy for heating and cooling.

THERMAL MANAGEMENT GRAPHITE FILMS

Natural and synthetic graphite materials with anisotropic properties created by their layered structure. Ideal for laminating and die-cutting.

BENEFITS

Worlds' most advanced thermal spread material, which is both lightweight and ultra thin, integrating into thermal management systems.



THERMAL & ELECTRICAL MANAGEMENT FOILS

Thermally conductive adhesive backed metallic foil tapes using aluminium, copper, embossed and tinned copper.

BENEFITS

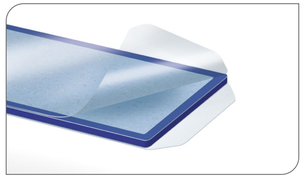
Combines high temperature resistance and thermal conductivity to provide excellent thermal spread properties reducing hot-spots and transferring thermal energy.

DOUBLE SIDED THERMALLY CONDUCTIVE ADHESIVE TAPES

Thermal transmission grade acrylic foam tape with very good peel adhesion and shear strength.

BENEFITS

Provides semi-structural bond to substrates with excellent thermal transmission.

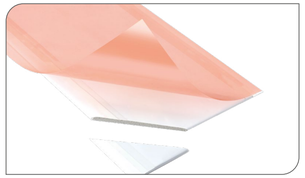


FRAMED ATP PADS FOR PRISMATIC CELLS

Advanced thermal cell barriers with built-in spacers for prismatic cells designed to prevent cell-to-cell thermal runaway.

BENEFITS

The built-in frame provides controlled spacing between cells while the adhesive layers increase stiffness of the battery pack or module. Thermal insulation materials prevent or delay thermal propagation from a thermal runaway event, optimises cell performance, and extends cell life.



ENCAPSULATED FIBRE ATP PADS FOR POUCH CELLS

Advanced encapsulated thermal cell barriers for pouch cells designed to prevent cell-to-cell thermal runaway.

BENEFITS

Delays or prevents thermal propagation from a thermal runaway event, and optimises cell performance through compression performance. Has the flexibility to incorporate additional layers to act as a heat transfer.

DID YOU KNOW...

As part of our end-to-end engineering and manufacturing process, we guide you through the complex material selection phase. At our in-house facility we have the capability to convert all our advanced materials into value added custom components engineered to your specific requirements.

MATERIAL SELECTION & VALIDATION

We specialise in understanding the science behind advanced materials to make careful selection based on the bespoke requirements of our automotive and battery partners.

DESIGNED FOR HIGH-VOLUME MANUFACTURE

We integrate design for manufacture principles into every stage of the product development process to ensure product enhancements and lower overall costs.

INNOVATIVE CONVERSION CAPABILITIES

Multi-layer lamination and advanced die-cutting processes provide unrestricted design capabilities by removing limitations and supporting engineering creativity.

FIND OUT MORE

Scan QR code to view the thermal management info on our website.

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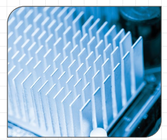
APPLICATIONS

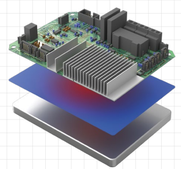
At Tecman we have years of experience meeting the challenges of thermal management, designing and manufacturing millions of thermal and electrical management components that are intelligently engineered to meet customer specifications.

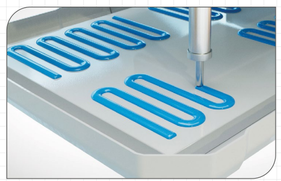
From conceptualisation to production, through to ongoing engineering support, our seamless and integrated process delivers solutions that solve persistent industry challenges, enhancing the performance and safety of the battery and exceeding project expectations.

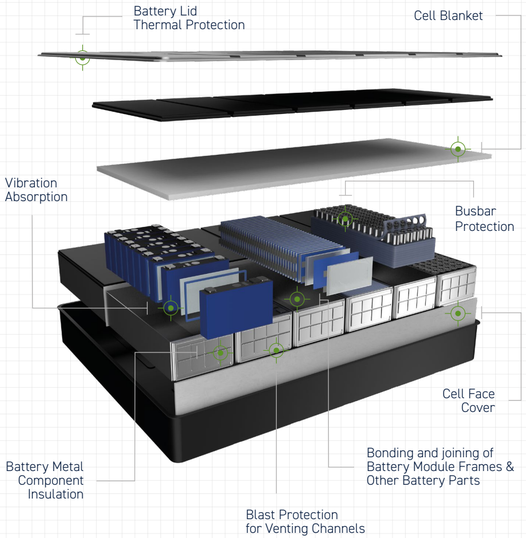


THERMAL INTERFACE MATERIALS (TIM)

Working with leading TIM products, advanced thermal transfer solutions are supplied as die-cut pads or liquid systems. These highly conductive products provide a thermal transfer path between components.



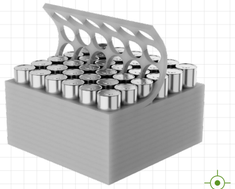




YOUR BESPOKE SOLUTION

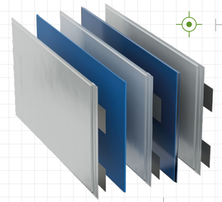
Got a challenging EV battery project?

Contact Tecman today; our expertise and bespoke approach to solving persistent industry challenges is ideal for collaborating on the solutions of tomorrow.



CYLINDRICAL CELL THERMAL RUNAWAY

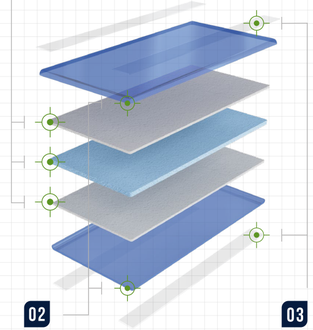
ATP solutions for cylindrical cells are a ground-breaking anti-thermal propagation technology. Lightweight insulation materials provide excellent passive protection and compression optimisation.



POUCH CELL THERMAL RUNAWAY

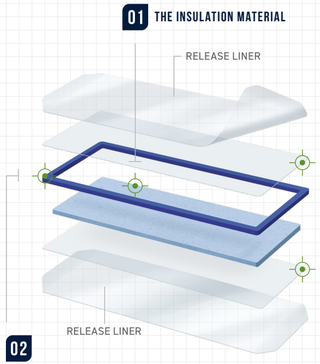
Encapsulated Fibre ATP Pads are a ground-breaking anti-thermal propagation technology for pouch cells. Using a combination of lightweight material technology and specialist encapsulation films these solutions prevent thermal propagation from a thermal runaway event.

01 ADVANCED INSULATION MATERIALS



02 ENCAPSULATION FILM

03 DOUBLE SIDED TAPE FOR BONDING TO CELL



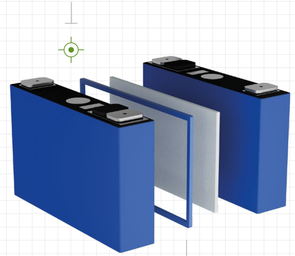
01 THE INSULATION MATERIAL

02 THE SPACER FRAME

03 THE ADHESIVE TAPE

PRISMATIC CELL THERMAL RUNAWAY

Framed ATP Pads are ground-breaking anti-thermal propagation technology with built-in spacers for prismatic cells. Using a combination of lightweight material and cell-spacer technology these solutions prevent thermal propagation from a thermal runaway event.



FIND OUT MORE

Scan QR code to view our E-mobility solutions on our website

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THERMAL MANAGEMENT PROPERTIES

There are various material characteristics to be considered when developing thermal management solutions for battery development.

Our Advanced Material Engineers work in collaboration with customer partners, providing engineering and material support at every stage of the process, ensuring that the complex material selection process and all the necessary considerations are navigated precisely and effectively.

THERMAL CONDUCTIVITY

This is a measure of the materials ability to conduct heat across the X-Y and Z axis and affects how and what materials are selected.

INSULATION VS CONDUCTION

The fundamental decision of whether to contain heat or take the heat away or to do both, results from a holistic understanding of the project and experience with cutting-edge thermal management solutions.

ENGINEERING DESIGN

Consideration of all elements of thermal management, including pre-heating and cooling, at every stage of the design process is key to supporting the innovation of form and function with high-performing and long-lasting components.

ENVIRONMENTAL CONDITIONS

With every project it is important to factor in the expected environmental exposure e.g. temperature, humidity, stress and strains that will be encountered through the life of the components.

DIELECTRIC STRENGTH

EV batteries & components with electric magnetic fields should be matched with insulating and protective parts that have appropriate dielectric strength to withstand breakdown, suppress arcing and prevent electric conductivity.

ADHESION STRENGTH

Relies upon an in-depth understanding of the adhesive, substrates, application methods, service environment and stresses. It is understood by measuring the tensile strength, shear resistance, and peel adhesion.

WHAT OUR CLIENTS

CLIENTS THINK

Tecman took on the challenge of manufacturing a complex multi-material thermal transfer product. Using innovation, engineering skills and advanced manufacturing capabilities, they took the product from drawing through feasibility and onto production level manufacturing.

I have worked with Tecman on several projects, I would without hesitation recommend Tecman as a manufacturing partner, whatever challenges they face they overcome them."

CHRIS HALLSWORTH
Thermal Management Consultant

The service from Tecman has been 1st class, over and above in every aspect of a difficult programme launch phase. From delivery and supply to ensure no disruption to technical support in product definition, problem solving and product improvements. Highly recommend"

SCOTT CARVER
Programme Quality Manager, Tier 1 Automotive Supplier

OUR

VALUE ADDED PROCESS

COLLABORATE

Working in close collaboration with our clients, we tailor our processes to meet their requirements.

INSIGHT

At the initial design stage of any project, our Advanced Material Engineers work with the client's design team to gain deep insight into the application and what it needs to achieve.

CONSIDER

Looking beyond the initial drawings to the end application, we carefully analyse and consider all aspects and focus on how we can improve overall performance.

INNOVATE

We develop an intelligent, forward-thinking solution that precisely matches product to needs.

ENHANCE

The final outcomes not only solve problems, they add value in ways that matter most: better performance, fast and easy assembly, lower overall costs and continuity of supply.

SUPPORT

Our extensive knowledge across multiple platforms enables us to provide the highest levels of ongoing technical support and customer aftercare.

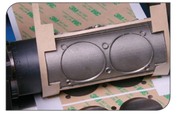
IN-HOUSE
MANUFACTURING FACILITIES

Tecman die-cut components incorporate pressure sensitive adhesive tape technology and advanced materials with customised liner configurations and presentation styles.

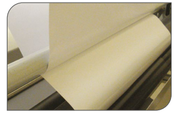
Our capabilities include rotary die-cutting machines with ultra-fast processing speeds up to 150 metres per min and up to 1.5 million parts per hour.

By utilising high speed precision rotary die-cutting equipment, multilayer lamination, in-line Corona Treatments and advanced slitting and sheeting methods the possibilities are endless.

- **STANDARDS** – Our facility in Leamington Spa, UK, holds both IATF 16949 and ISO 9001:2015 certifications. Additionally, our robust systems include APQP, NPI, Engineering Change Control, and Six Sigma, to ensure the highest standards at every stage of your project.
- **PRODUCT APPROVALS** – Prototype testing and pre-production parts supplied for sign-off, including OEM approvals.
- **PRODUCT TESTING** – Thermal cycling, environmental cycling and adhesion testing.
- **R&D** – Our team conduct adhesive and material testing and prototype development in-house and in collaboration with our client's teams.



▲ HIGH PRECISION ROTARY DIE CUTTING



▲ MULTI-LAYER LAMINATION

PRODUCT INFORMATION

DOUBLE-SIDED THERMALLY CONDUCTIVE ADHESIVE TAPES

DENSITY	TOTAL THICKNESS (ASTM D-1000)	SURFACE RESISTANCE (ASTM D-257)	THERMAL CONDUCTIVITY	VOLUME RESISTANCE (ASTM D-257)	DIELECTRIC BREAKDOWN VOLTAGE (IEC-60243-1)	DIELECTRIC STRENGTH (IEC-60243-1)	SHORT TERM (4HR. 100G) (ASTM D-3654)	LONG-TERM (10,000MIN. 250G) (ASTM D-3654)
1500 to 1600 Kg/m^3	0.05mm to 1.20mm	3.0 x 10^{15} Ω or 5.0 x 10^{14} Ω	1 to 3 W/mK	1.0 x 10^{17} Ω/cm or 2.0 x 10^{13} Ω/cm	3.75 to 18 kV	15 to 40 kV/mm	121°C to 160°C	93°C to 100°C

THERMAL INTERFACE MATERIALS (TIM)

SUB-CATEGORIES	THERMAL CONDUCTIVITY (ASTM D 5470)	HARDNESS (SHORE 00)	SPECIFIC GRAVITY	ELECTRICALLY INSULATING	BREAKDOWN STRENGTH (AC KV/MM)	THICKNESS	OPERATING TEMP	BASE MATERIAL	SILOXANE OUT GAS (D4-D10)
Gap Filler Liquids	2.0 to 6.0 W/mK	5 to 55	1.95 to 3.44 g/cc	> 10 kV/mm	-	-	-40°C to 150°C	-	< 70ppm
Thermally Conductive Pads	1.4 to 35 W/mK	20 to 75	1.8 to 3.3 g/cc	-	<0.1 to >10 kV/mm	0.2mm to 7.0mm	-40°C to 150°C	Silicone	< 70ppm

THERMAL & ELECTRICAL MANAGEMENT FOILS

BACKING TYPE	BACKING THICKNESS	ADHESIVE TYPE	ADHESIVE THICKNESS	COLOUR	PEEL ADHESION	THERMAL CONDUCTIVITY (XY)	CONTINUOUS TEMP RANGE
Copper, embossed & tinned copper, PET/Aluminium	0.012mm to 0.125mm	Acrylic, thermally conductive or electrically conductive	0.007mm to 0.135mm	Copper or silver	Low to Medium	100 to 401 W/mK	Various between -30°C to 155°C

THERMAL MANAGEMENT GRAPHITE FILMS

SUB-CATEGORIES	THICKNESS	DENSITY	THERMAL CONDUCTIVITY (XY)	THERMAL CONDUCTIVITY (Z)
Natural Graphite	0.030mm to 0.940mm	> 1200 kg/m^3	Various between 400 to 1300 W/mK	≥ 5 W/mK
Synthetic Graphite	0.017mm to 0.040mm	> 1600 kg/m^3	Various between 1200 to 1800 W/mK	≥ 10 W/mK

SPECIALIST THERMAL INSULATION MATERIALS

MATERIAL	THERMAL CONDUCTIVITY	DENSITY	COMPRESSIVE RESISTANCE	DIELECTRIC CONSTANT (ASTM D150)	VOLUME RESISTIVITY (ASTM D257)	SERVICE TEMP	MAX TEMP
Superior light-weight material technology	24 to 54 mW/m-K	0.20 g/cc	8 kPa @ 10%, 90 kPa @ 25%, 310 kPa @ 50%	1.3 to 1.51	2.8 x 10^{12} Ω/cm	-40°C to 600°C	850°C

CHALLENGE TECMAN TODAY

Through ongoing investment in our people, capabilities, partnerships, and R&D we keep quality standards at their highest and ensure world-class technical capabilities and imaginative thinking that really make a difference.

Our creative and collaborative approach to new projects has enabled the development of solutions to seemingly impossible challenges, whilst building long-lasting partnerships with our customers and supply partners based on mutual respect.

We don't subscribe to one-size-fits-all. Every project is evaluated on an individual basis and formatted to surpass expectations. Through careful consideration of what our customers' end application needs to achieve, we develop solutions designed to add value, increase efficiency, and improve performance of the finished project.

Contact a member of our team, who will be happy to discuss your requirements and establish how we can bring thermal management improvements to your E-mobility project.

VALUES THAT ENHANCE PERFORMANCE

We recognise the importance that our culture and company values have on effective collaboration and growing our customer partnerships. So, we commit to continue:

PIONEERING SPIRIT
With an inherent drive for innovation

SURPASS EXPECTATIONS
In everything we do through our devoted enthusiasm

AMBITIOUSLY SUSTAINABLE
Both financially and environmentally, to help improve the lives of our team, our families, and our communities

TOGETHERNESS
We can always achieve greater things by working together in collaboration with all stakeholders

HERE TO HELP

Please get in touch to find out how we can collaborate with your team to provide advanced thermal management solutions for your existing application or new project. We look forward to hearing from you soon.

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MAKE AN ENQUIRY
Scan QR code for quick link to our enquiry form.

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