Company Introduction 2024

CK EMSOLUTION

CK EM SOLUTION

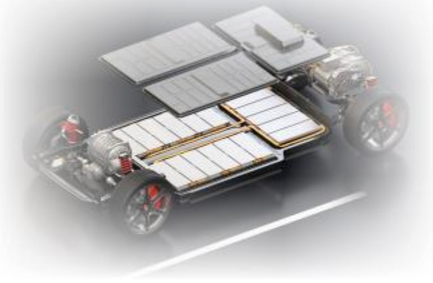
01

COMPANY OVERVIEW

CKEMS Introduction

01 Company overview

Company Name	CK EMSolution Co., Ltd.
CEO	YANG KWANG-YONG
Date of Establishment	2021.10.01
Capital	5.6 billion won
number of Employees	40 （2023.11）
Business Area	Thermal Interface Adhesive Coating Solution Eletronic Material and Coating Solution
Location Site	- KOR : 58, Daepungsandan-ro, Daeso-myeon, Eumseong-gun, Chungcheongbuk-do, Republic of Korea - USA : 259 Casablanca Dr, Macon, GA 31217 USA - HUN : Heves, Egri u. 26, 3360 Hungary
Parent Company	CHO KWANG PAINT



Global Supply Chain

3 SITE

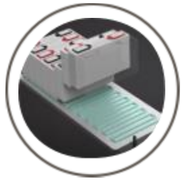
KOR, USA, HUN FACTORY
OPERATIONS SETUP COMPLETED

Competitiveness

Lightweight & High Efficiency

USAGE DOWN, EFFICIENCY UP.
TIM SECTOR BOASTS ALL SOLUTIONS

CORE BIZ.



TIM

THERMAL INTERFACE MATERIAL

PARENTS COMPANY

CHOKWANG PAINT

A COMPREHENSIVE PAINT COMPANY
WITH A HISTORY OF 78 YEARS

ESTABLISHMENT

2021

AFTER PRODUCT DEVELOPMENT, ESTABLISHMENT OF A CORPORATION, WITH 100% INVESTMENT FROM THE PARENT COMPANY

BRAND

NOVASOLIS

CK EM SOLUTION'S PROPOSED 'NEW FUTURE' BI REGISTRATION

02

Company History

CK EM Solution, established as a subsidiary of Chokwang Paint after completing incubating development for new growth engines

1947~2016

ChoKwang Paint Growth

1947 Establishment of Chokwang Paint
1988 Establishment of Chokwang Jotun, a joint venture with Jotun in Norway
2016 Presidential Commendation for Fair Trade Day

2012~2020

New Business Development

2012 Development of LG Chem's urethane and hardener
2018 Supply of LG Chem's urethane (~ until 2020)
2020 Establishment of TFT Team for Heat Dissipation and Commencement of Urethane TA Development

2021~2023

CKEMS Setup

2021 The high-hardness urethane TA module tests are completed (both for 1w and 2w)
2021 Establishment of CKEMS_KOR, USA, HUN
2022 KOR, HUN Factory Completion
2023 USA Factory Completion

2023 ~

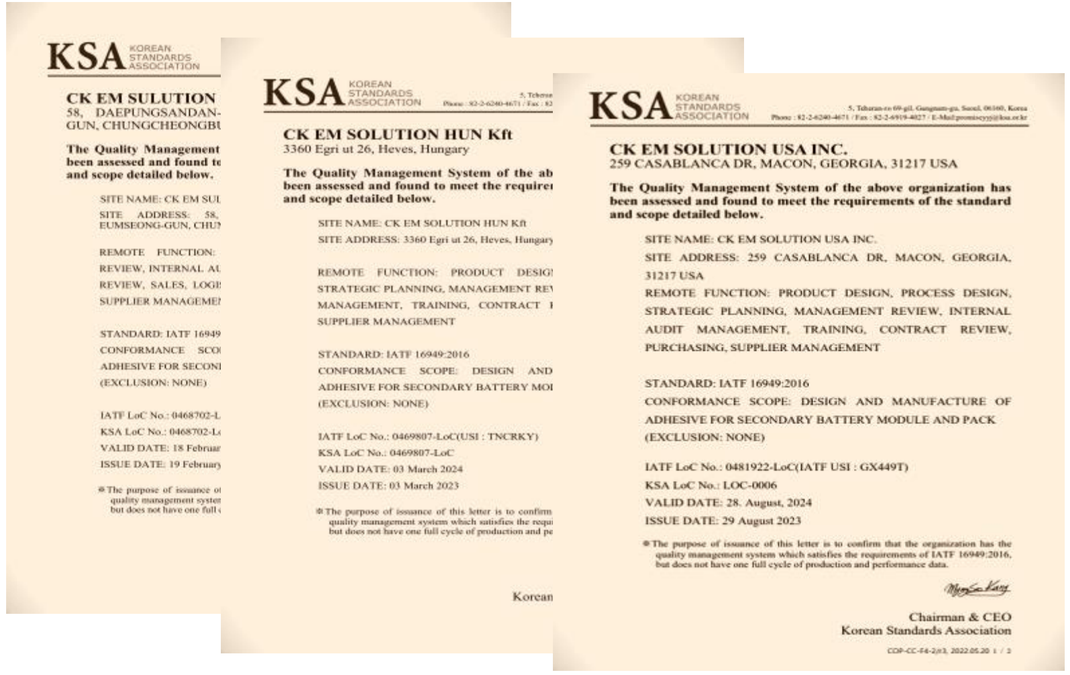
Business ramp up

2023 Urethane TIM Low-hardness module
3 Site IATF 16949
3 Site Factories Set-up completed
VDA 6.3 in progress

03 Certification & Patents

IATF16949(Automotive Quality Management) Certification approved

Category	KOR	HUN	USA
Certification Date	2023.02.19	2023.03.03	2023.08.24
Certification NO.	0468702-LOC	0469807-LOC	0481922-LOC



KSA KOREAN STANDARDS ASSOCIATION

CK EM SULUTION
58, DAEPUNGSANDAN-
GUN, CHUNGCHEONGBU

The Quality Management
been assessed and found t
and scope detailed below.

SITE NAME: CK EM SUL
SITE ADDRESS: 58,
EUMSEONG-GUN, CHU

REMOTE FUNCTION:
REVIEW, INTERNAL AU
REVIEW, SALES, LOGI
SUPPLIER MANAGEME

STANDARD: IATF 16949
CONFORMANCE SCO
ADHESIVE FOR SECONI
(EXCLUSION: NONE)

IATF LoC No.: 0468702-L
KSA LoC No.: 0468702-L
VALID DATE: 18 Februar
ISSUE DATE: 19 February

※The purpose of issuance o
quality management syste
but does not have one full

KSA KOREAN STANDARDS ASSOCIATION

CK EM SOLUTION HUN Kft
3360 Egri ut 26, Heves, Hungary

The Quality Management System of the ab
been assessed and found to meet the require
and scope detailed below.

SITE NAME: CK EM SOLUTION HUN Kft
SITE ADDRESS: 3360 Egri ut 26, Heves, Hungary

REMOTE FUNCTION: PRODUCT DESIG
STRATEGIC PLANNING, MANAGEMENT RE
MANAGEMENT, TRAINING, CONTRACT
SUPPLIER MANAGEMENT

STANDARD: IATF 16949:2016
CONFORMANCE SCOPE: DESIGN AND
ADHESIVE FOR SECONDARY BATTERY MO
(EXCLUSION: NONE)

IATF LoC No.: 0469807-LoC(USI : TNCRKY)
KSA LoC No.: 0469807-LoC
VALID DATE: 03 March 2024
ISSUE DATE: 03 March 2023

※The purpose of issuance of this letter is to confirm
quality management system which satisfies the requi
but does not have one full cycle of production and pe

Korean

KSA KOREAN STANDARDS ASSOCIATION

CK EM SOLUTION USA INC.
259 CASABLANCA DR, MACON, GEORGIA, 31217 USA

The Quality Management System of the above organization has been assessed and found to meet the requirements of the standard and scope detailed below.

SITE NAME: CK EM SOLUTION USA INC.
SITE ADDRESS: 259 CASABLANCA DR, MACON, GEORGIA, 31217 USA
REMOTE FUNCTION: PRODUCT DESIGN, PROCESS DESIGN, STRATEGIC PLANNING, MANAGEMENT REVIEW, INTERNAL AUDIT MANAGEMENT, TRAINING, CONTRACT REVIEW, PURCHASING, SUPPLIER MANAGEMENT

STANDARD: IATF 16949:2016
CONFORMANCE SCOPE: DESIGN AND MANUFACTURE OF ADHESIVE FOR SECONDARY BATTERY MODULE AND PACK (EXCLUSION: NONE)

IATF LoC No.: 0481922-LoC(IATF USI : GX449T)
KSA LoC No.: LOC-0006
VALID DATE: 28. August, 2024
ISSUE DATE: 29 August 2023

※The purpose of issuance of this letter is to confirm that the organization has the quality management system which satisfies the requirements of IATF 16949:2016, but does not have one full cycle of production and performance data.

Chairman & CEO
Korean Standards Association

COP-CC-F4-2(r3, 2022.05.20 1 / 1

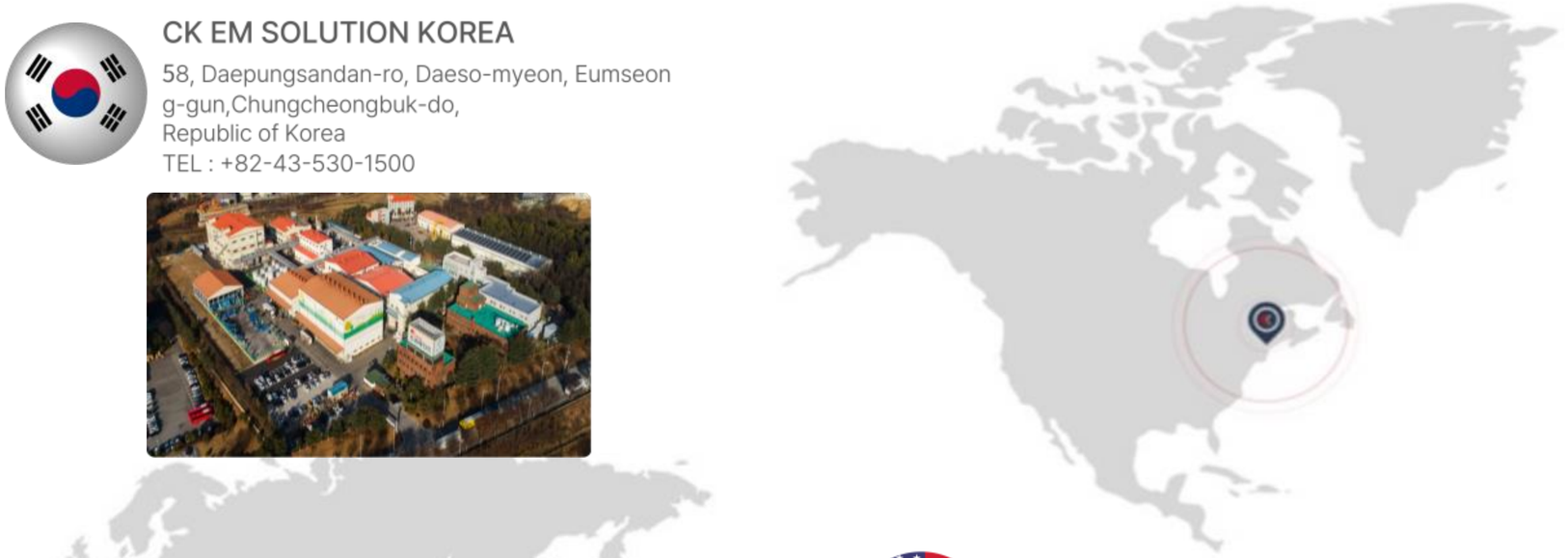
Held Patents

Category	Patents No.	특허명
Patent	No. 10-1736898	"Composition of Coating Material for Electromagnetic Shielding"
Patent	No. 10-1958240	"UV-curable coating composition for electromagnetic shielding film protection"
Patent	No. 10-2397281	"Lightweight Heat-dissipating Adhesive Composition and its Manufacturing Method"
Patents	No. 10-2457897	"Thermally Conductive Adhesive Composition with Low Dielectric Properties and its Manufacturing Method"

*BI registration:
NOVASOLIS domestic trademark registration, European Madrid trademark registration completed

04 Global Networks

As a proactive Investment for entering the global market, Preparation for overse as subsidiary production completed



CK EM SOLUTION KOREA

58, Daepungsandan-ro, Daeso-myeon, Eumseon g-gun,Chungcheongbuk-do,
Republic of Korea
TEL : +82-43-530-1500

CK EM SOLUTION HUNGARY

Heves,Egri u. 26, 3360 Hungary
TEL : +36-30-099-5244

CK EM SOLUTION USA

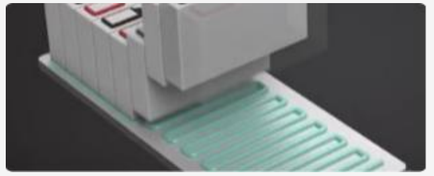
259 Casablanca Dr, Macon, GA,31217 USA
TEL : +1-478-342-6009

05 Products Portfollo

Providing customizied TIM Solution to Customers

Product 1

Urethan TIM



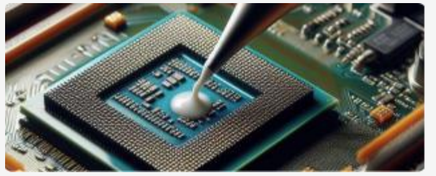
Application
· Secondary Battery Module and Pack

Function
· Attaching battery cells and heat sinks
· External Vibration
· Shock Protection
· Rapid Heat Transfer of Battery
· Maintaining BatteryTemperature

Edge
· Low weight, lightweighting
· Excellent thermal conductivity
· cost save

Product 2

Liquid Silicone TIM



Application
· Secondary Battery Pack Automotive Electric Part, DC-DC Converter

Function
· Attaching Battery Modules and Sub-cooling Plates for Heat Transfer
· Attaching heat sinks and PCB components for heat transfer

Edge
· Low weight, lightweighting
· Excellent thermal conductivity
· cost save

Product 3

Silicone TIM PAD

Application
· CPU, IGBT unit, and heat-generating electronic components

Function
· Thermal Management of Electronic Components
· Extending Lifespan & Maintaining Performance of Electronic Devices"

Edge
· High flexibility
· High insulation

Pruduct 4

Epoxy TIM

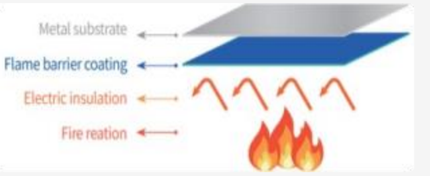
Application
· Energy Storage System (ESS)

Function
· Peak Power Management
· Attachment of ESS Modules and Packs
· Heat Dissipation and Protection of Modules and Packs

Edge
· Excellent Weathering resistance

Product 5

Flame barrier coating



Application
· Battery case for secondary batteries
· Busbar Frame

Function
· Possibility curable on the room temperature
· Possibility Fire Resistance Performance in Various Materials
· After exposure to flames, maintaining insulation performance

Edge
· Excellent Impact resistance

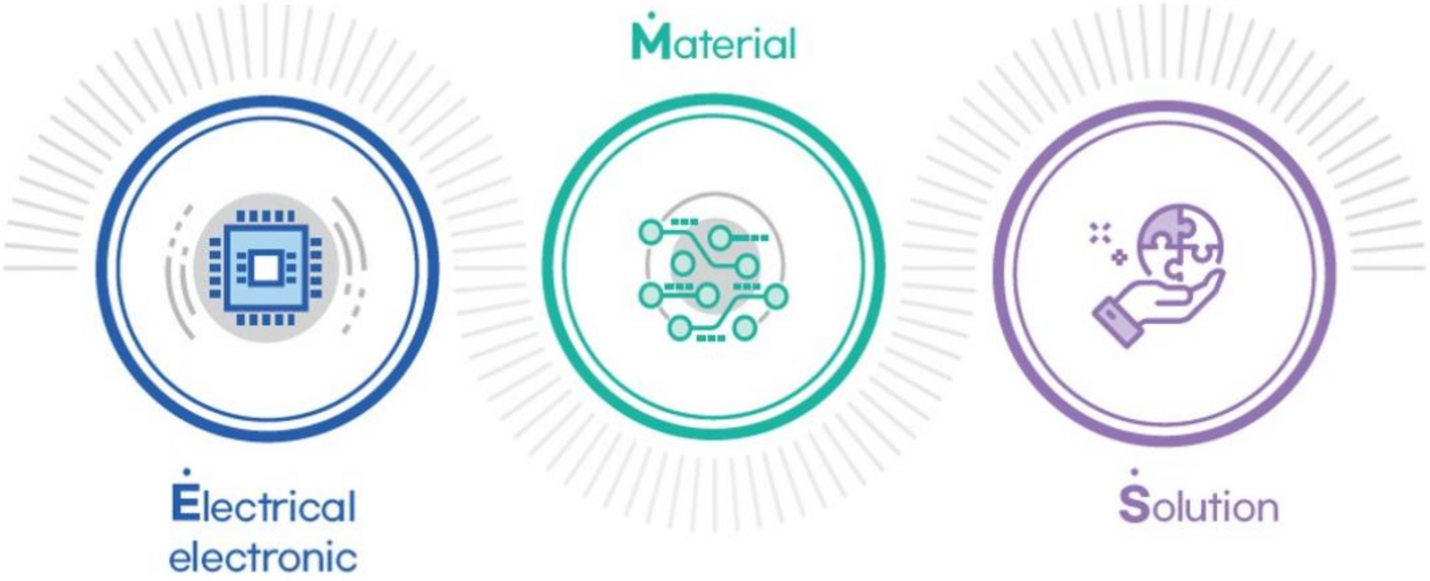
02

OUR COMPETITIVENESS

CKEMS 's Competitiveness

1) VISION
2) R&D capability
3) TIM specialist company
4) Low weight, High efficiency

"Global Leading Total Solution Provider in Electrical & Electronic Materials"



CK EM Solution Co., Ltd. is a specialized company in the field of electric/electronic materials solutions, based on precision synthesis technology and material application expertise

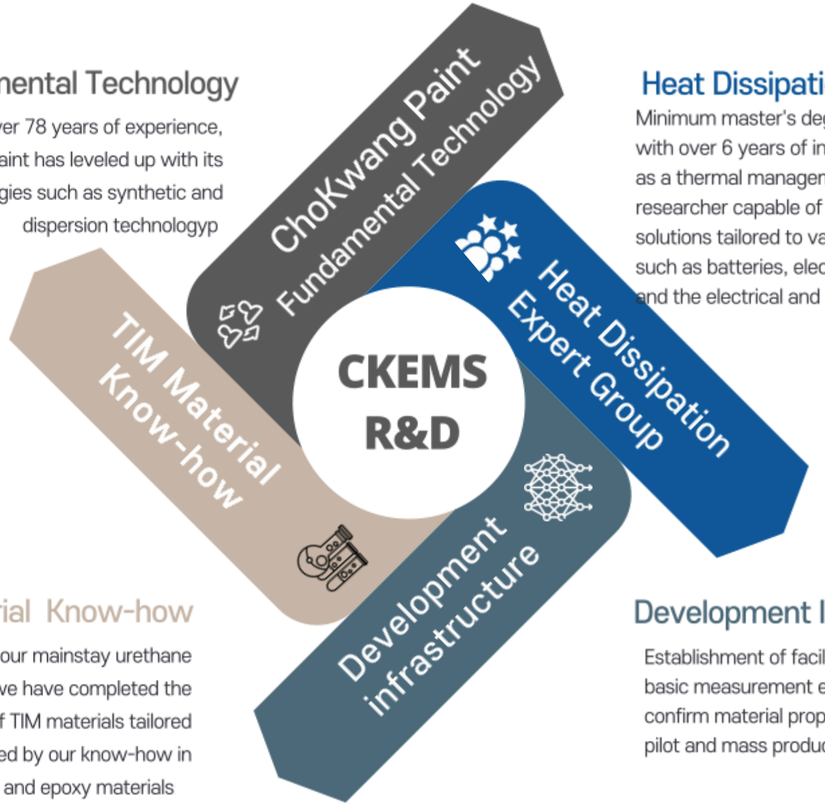
02

EMS Competitiveness ① _R&D capability

Providing customers with the most optimized solutions through material technology and application field know-how

CKP Fundamental Technology

Boasting over 78 years of experience, Chokwang Paint has leveled up with its core technologies such as synthetic and dispersion technologyp



Heat Dissipation Expert Gruop

Minimum master's degree or equivalent, with over 6 years of industry experience as a thermal management specialist researcher capable of providing optimized solutions tailored to various industries such as batteries, electric vehicles, ESS, and the electrical and electronics field

TIM Material Know-how

Alongside our mainstay urethane materials, we have completed the development of TIM materials tailored to resins, backed by our know-how in silicone and epoxy materials

Development Infra.

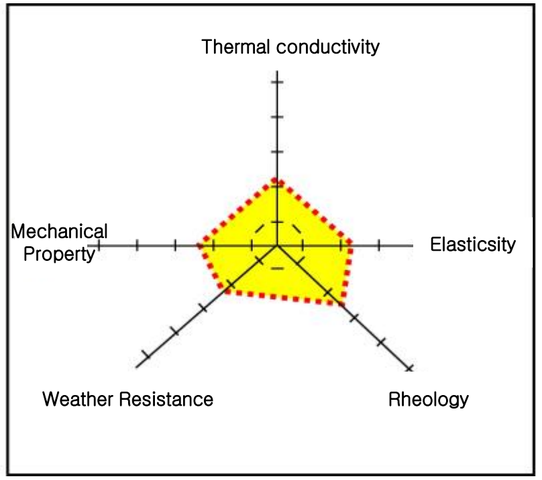
Establishment of facilities not only for basic measurement equipment to confirm material properties but also for pilot and mass production testing

Development infrastructure

EMS Competitiveness ② TIM specialist company

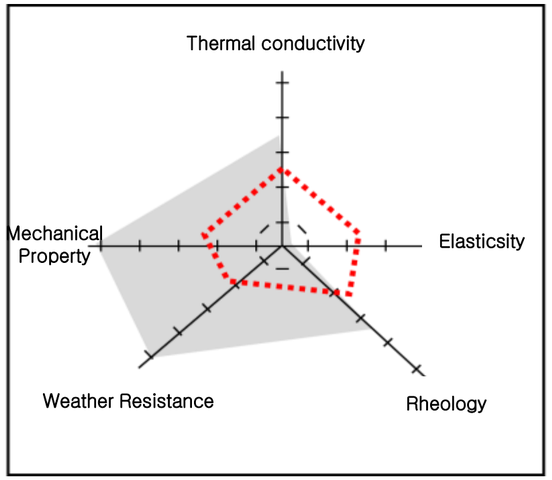
CK EMS possesses excellent Know-how in TIM materials

Required characteristics for electric vehicle TIM



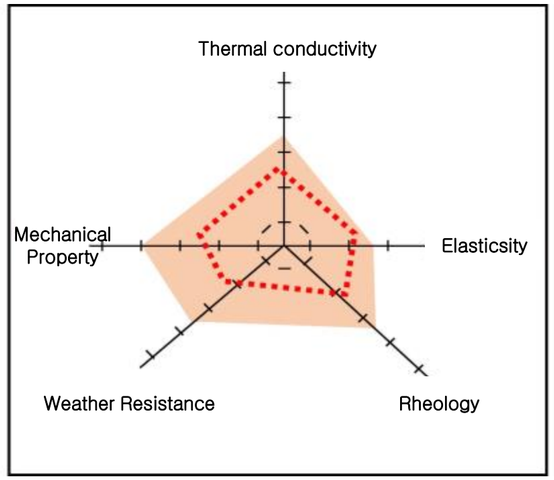
VS

Epoxy



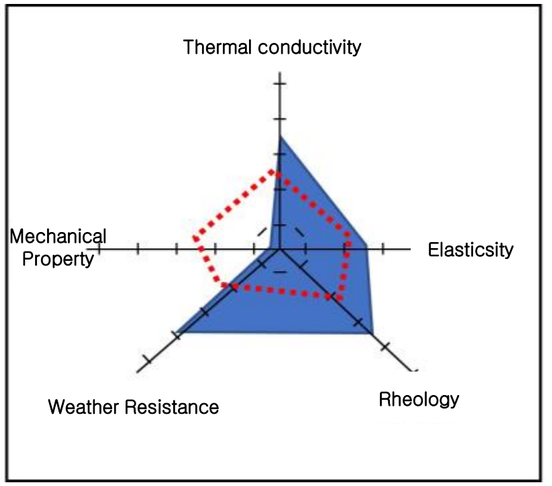
- Application :
  Energy Storage System (ESS)

Urethane



- Application :
  Secondary Battery Module and Pack
  Transitioning from Silicone GapFiller to Urethane TIM

Silicone



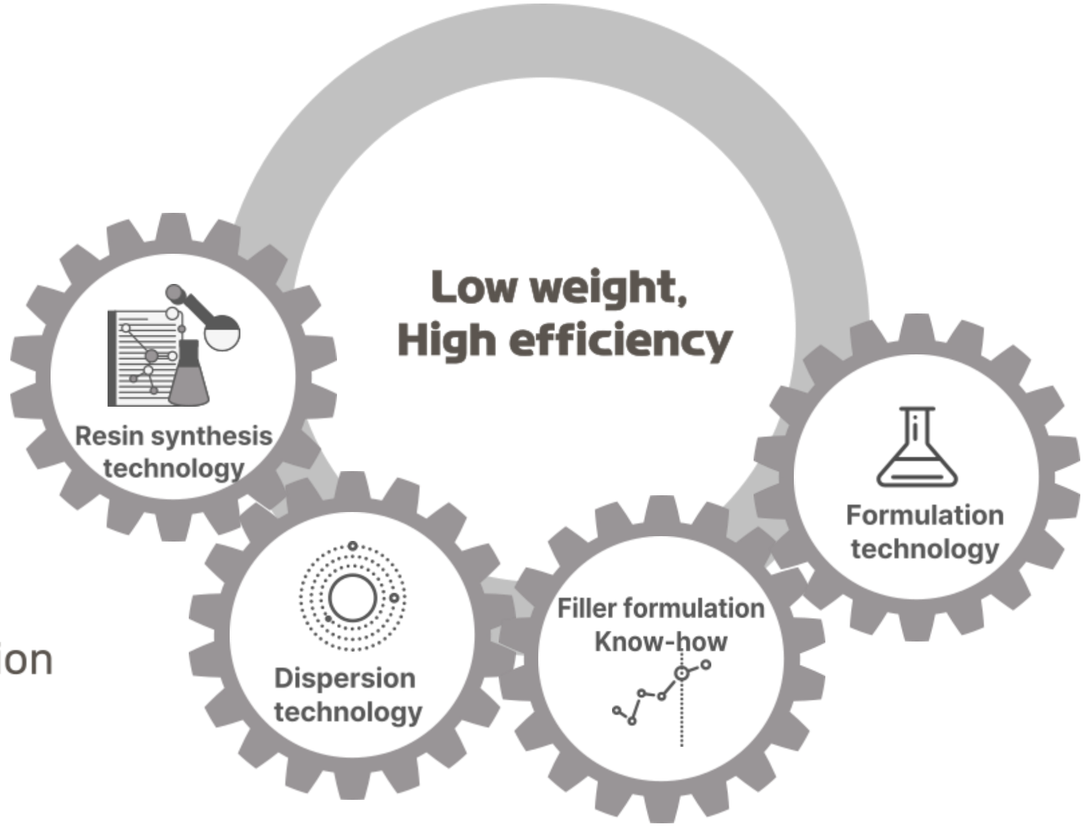
- Application :
  Secondary Battery Pack
  Automotive Electric Part, DC-DC Converter

Mplementing the optimization of the required characteristics for electric vehicles through CKEMS's expertise

EMS Competitiveness ③ Low weight, High efficiency

Through the implementation of low weight, high efficiency technology, provide benefits to customers such as lightweighting and cost savings

ITEM	Existing product (2W/mk)	Our product (2W/mk)	Improvement Effect
Specific Gravity (g/ml)	2.5	2.1	16%
Cooling Effciency (△T/W)	1.31	1.01	Cooling Efficiency up



- Low specific Gravity compared to competitors
  : When applied to the same volume, there is a 16% reduction in lightweight and cost savings effect
- **Excellent cooling efficiency**
  : Extended battery lifespan with the same battery usage

EMS Competitiveness ④ Overseas subsidiary Ready to...

Preparation for overseas subsidiary(USA, HUN) production completed

Macon Plant/USA

- Location: Macon, Georgia, USA
- Total Area : 29,126m^2
  * 1 Factory : Area 10,000m^2, Building 3,157m^2, Max.Capa. 3,500tons/year
  * 2 Factory : Area 7,060m^2, Building 8,910m^2, Max. Capa. 24,000tons/year능

Heves Plant/HUN

- Location: Heves, Hungary
- Total Area : 34,000m^2
  *1 Factory : Area 10,000m2, Building 3,8066m^2, Max. Capa. 3,000ton/year
  *2 Factory : Area 13,000m^2, Building 3,420m^2, Max. Capa. 3,000ton/year
  - 3 Factory : Area 11,000m^2

Eumseong HQ/KOR

- Located in Daeso-myeon, Eumseong-gun, Chungcheongbuk-do-Chokwang Paint (Eumseong) Factory
- Manufacturing Space : 14,877m^2
- Capa.: 300tons

03

OUR PRODUCTS

CKEMS 's Products

Urethane TIM

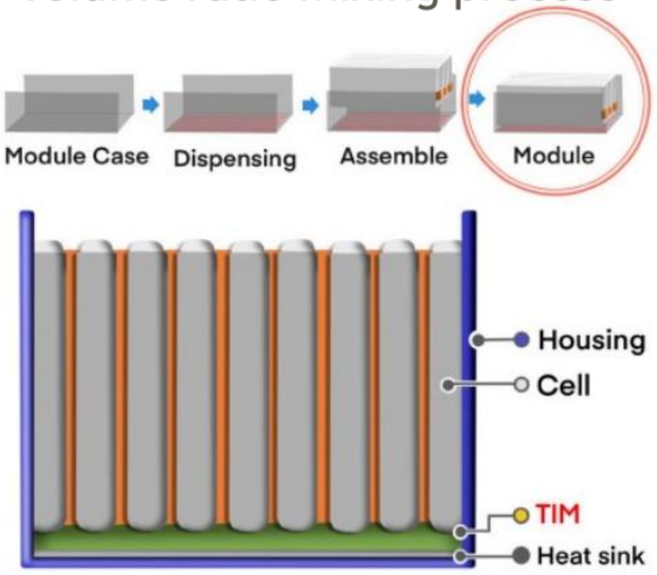
· 2K adhesive composed of polyol resin and isocyanate

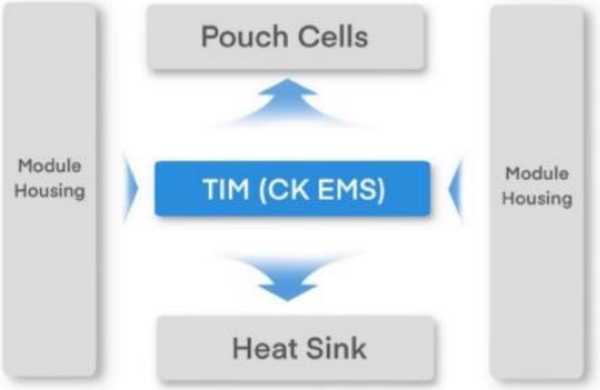
· Solvent free type adhesive cured at room temperature

· Applied to the device which requires the heat management by thermal conductive performance

· Excellent thermal conductivity, weather resistance, durability,mechanical and electrical properties

· Excellent workability with 1:1 volume ratio mixing process





01 Urethane TIM

CKE-TAU-102 1W High hardness type

Requirement	Unit	Function	Requirement	Result	Test Methodology
Color (Base/Hardener)	-	-	-	Green/White	
Operating Temperature	℃	OEM Require	-40° C ~ 85° C	-40 ~ 85	-
Base Material	-	-	Urethane (Epoxy, Silicone)	Urethane	-
Mix Ratio	-	OEM Require	1 : 1	Volume ratio 1 : 1	-
Density (Base/Hardener)	g/ml	Module Weight	≤ 2.1 (Mix)	1.95 (Mix)	ASTM D1475
Viscosity (Resin/Hardener/Mixture)	Pa.s	Utility Requirement	Anton-Paar rheometer	535 / 508 / 552 (@1/s)	ASTM D2196
Thixotropic Index (Base/Hardener)	-	Utility Requirement	≥ 2.5	3.88 / 3.12 / 3.61	ASTM D2196
Working Time (2X Viscosity)	Min	Production	≥ 30	31	ASTM D2196
Handling Time (1MPa)	Hour	Quality Requirement	≤ 10	4	ASTM D1002
Curing Time (LSS기준)		Quality Requirement	≤ 48	41	ASTM D1002
Shrinkage	%	-	-	0	-
Thermal Conductivity (Thickness 5mm)	W/mK	Thermal Performance	≥ 1	1.32	ISO 22007-2
Hardness (Thickness 6mm)	Shore D	Pouch Damage	55	52	ASTM D2240
Lap Shear Strength (Thickness 0.3mm)	MPa	Vibration/ Shock	Avg. 10 (기준시편) Avg. 7.5 (SKI 시편)	10.22 (기준시편)	ASTM D1002
Peel Strength (Thickness 0.3mm)	gf/cm	Adhesion	Avg. 2000 (기준시편) Avg. 750 (SKI 시편)	2600 (기준시편)	ASTM D903
Volume Resistance (Thickness 1mm)	Ohm.cm	Insulation	≥ 10^13	$2.47X10^{13}$	ASTM D257
Surface Resistance (Thickness 0.3mm)	Ohm.sq	Insulation	≥ 10^13	$3.34X10^{14}$	ASTM D257
Breakdown Voltage (Thickness 0.3mm)	kV/mm	Insulation	≥ 10	21.2	ASTM D149
Flammability (Thickness 3mm)	-	OEM Require	V0	V0	UL V-, VTM- Test
Dielectric Constant (Thickness 3mm)	-	Module/System Y-Capacitance	≤ 9 (@1kHz) ≤ 7 (@1MHz)	6.93 (@1kHz) 5.60 (@1MHz)	ASTM D150
TGA Residue (Resin/Hardener)	%	-	< 55	49.3 / 54.1	800℃ residue weight%

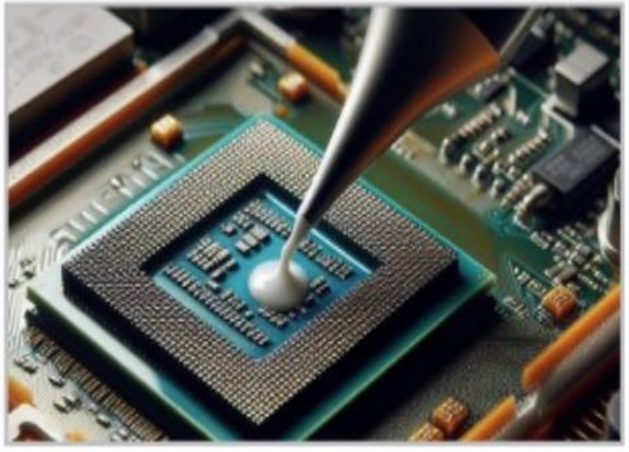
CKE-TAU-104 1W Low hardness type

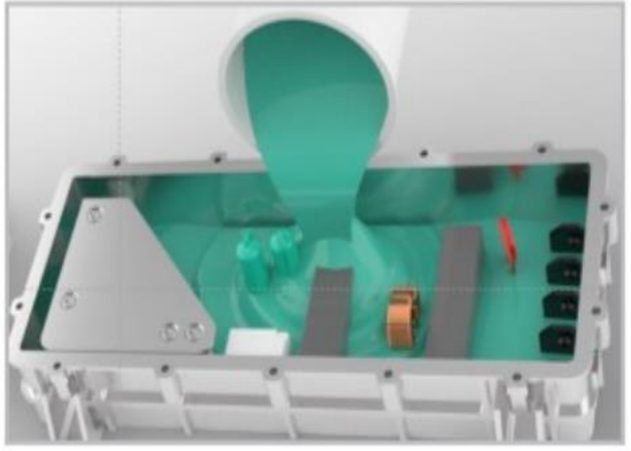
Test item		Test Methodology	Unit	Storage period	
				Target	Properties
LOT No. (Base / Hardener)		-	-		(230524B2 / 230524H2)
1. Density (Resin / Hardener)	Base	ASTM D1475	g/ml	< 1.95	1.95
	Hardener				1.95
	Mix				1.95
2-1. Viscosity (@0.5/1/5/s)	Base	ASTM D2196	Pa.s	350 ~ 400	348
	Hardener				359
	Mix				357
2-2 Thixotropic index ($@0.5s^{-1}/5s^{-1}$)	Base	ASTM D2196	-	> 2.5	3.34
	Hardener				2.88
	Mix				2.87
3. Working Time		ASTM D2196	min	> 50	Min. 55.8
4. Hardness		ASTM D2240	Shore A	50 ~ 60	Min. 54
					Max. 55
5. Shrinkage rate			%	< 0.5	0.17
6. Thermal Conductivity		ISO 22007-2	W/mK	1.0 ~ 1.4	1.15
7. Lap Shear Strength		ASTM D1002	MPa	> 1.5	Avg. 2.32
8. Peel Strength		ASTM D903	gf/cm	> 400	Avg. 751
9-1. Elastic modulus		ASTM D638, Type 4	MPa	< 5	2.97 (0.5~3%) 2.59 (0.5~5%)
9-2. Elongation		ASTM D638, Type 4	%	> 220	253
10-1. Curing time		ASTM D1002	hours	< 48	< 48
10-2. Handling time		ASTM D1002	hours	< 8	< 8
11-1. Volume Resistance		ASTM D257	Ohm.cm	> 10^11	1.06^11
11-2. Surface Resistance		ASTM D257	Ohm.sq	> 10^12	1.70^12
11-3. Breakdown Voltage		ASTM D149	kV/mm	> 10	17.1
12. Dielectric constant		ASTM D150	-	< 6.2 (1kHz/1V)	5.5
				< 5.8 (1MHz/1V)	5.1
13. Flammability		UL V-, VTM- Test	-	V0	V0
14. Thixotropy		ASTM D2202	mm		3.15
15. TGA residue (Resin/Hardener)		800℃ residue weight%	%	< 60	Base 54.5 Hardener 55.2

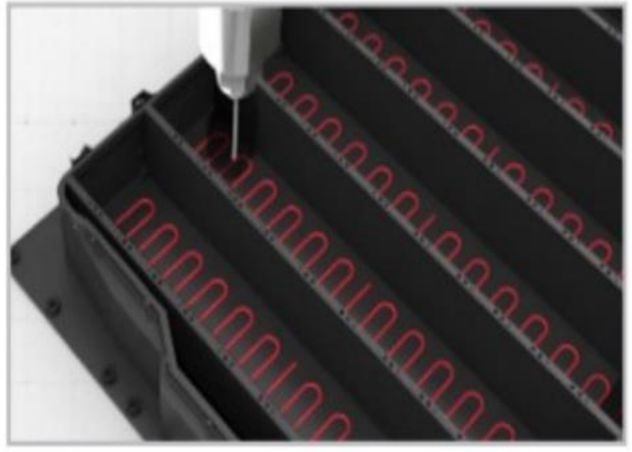
02

Liquid Silicone TIM

· A product composed of polyvinylsiloxane and hybrid. It provides 1K type grease and 2K(2components) type TIM products. There are no by-products caused by the addition reaction and it can be applied to all parts that require thermal management because of the advantage of fast hardening at room temperature







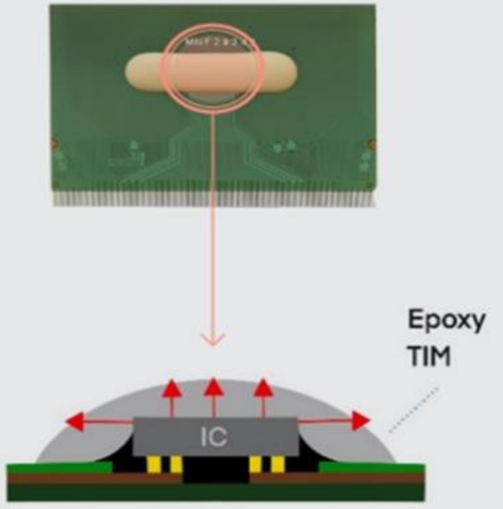
Liquid Silicone TIM

	TGS-C2002	TGS-C3002	Test methodology
Density	2.7 ± 0.2	2.1 ± 0.2	ASTM D1475
Viscosity (Pa·s)	200 ~ 400	200 ~ 400	ASTM D2196
Ratio (Base : Hardener)	1 : 1	1 : 1	Volume ratio
Thermal conductivity (W/mK)	3.0	3.0	ASTM D7984
Volume resistance (Ωcm)	> 1 x 10^{13}	> 1 x 10^{13}	ASTM D257
Breakdown voltage (kV/mm)	13	15	ASTM D149
Frammability	V0	V0	UL-94

Epoxy TIM

- Adhesive composed of epoxy resin and hardener
- Applied to the device which requires the heat management by thermal conductive performance
- Excellent thermal conductivity, weather resistance, durability, mechanical and electrical properties
- Applied to fields requiring reliability (energy storage devices, Drive IC)

Energy Storage System (ESS)



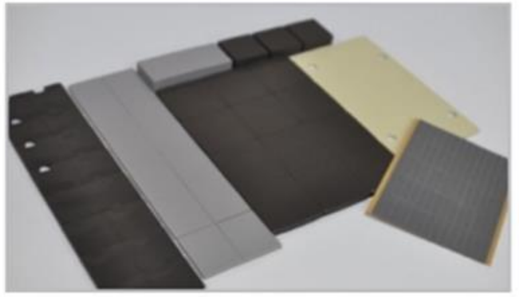
Drive IC

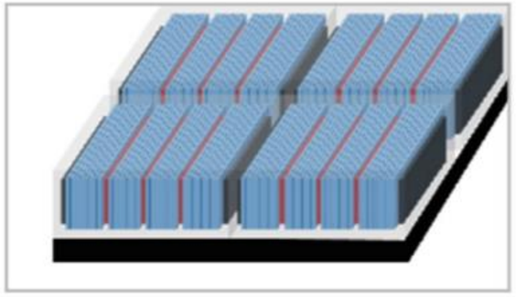
Epoxy TIM

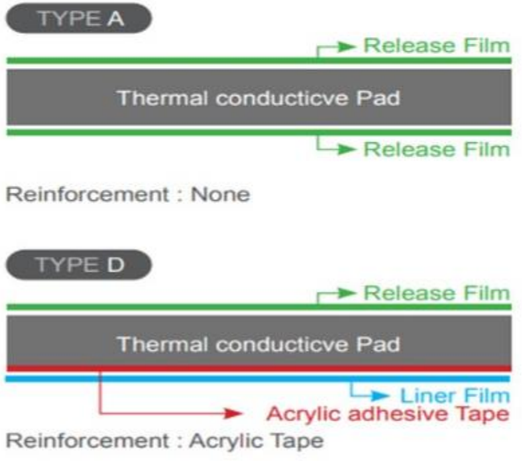
	TAE-CR001		Test methodology
	Base	Hardener	
Viscosity (Pa.s)	150±50	200±50	ASTM D2196
Mix Viscosity (Pa.s)	150 ± 30		
Density	2.4	2.4	ASTM D1475
Thermal conductivity (W/mK)	3.0		ISO 22007-2
Flammability	V0		UL V-, VTM- Test
Hardness	50 ~ 70		ASTM D2240
Lap shear strength (Mpa)	5.6		ASTM D1002
Volume resistance (Ωcm)	8.6 × 10^10		ASTM D257

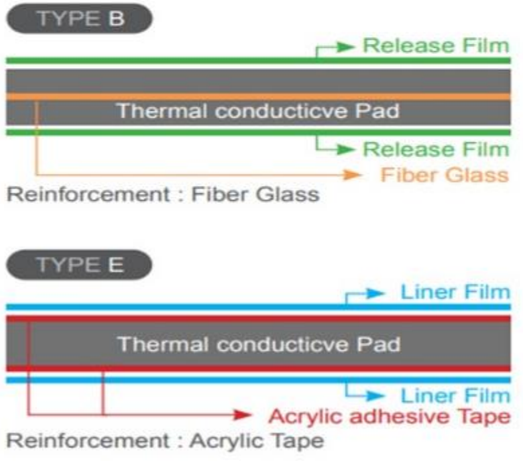
Silicone PAD

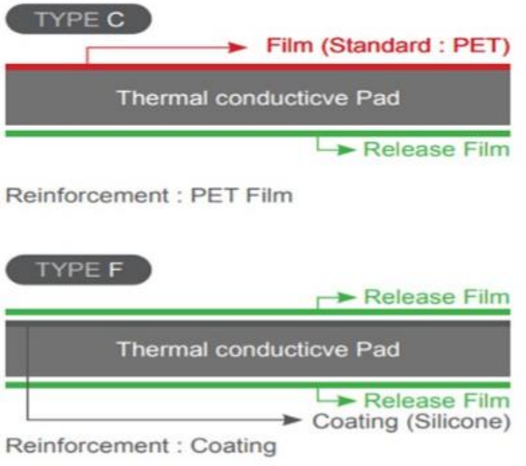
· It is a heat dissipation material that transfers heat generated from electronic devices, internal combustion engine vehicles, EVs, etc. to the outside. It is mixed with silicone resin and the heat conductive filler and is customized to meet the customer's needs.












EM
SOLUTION