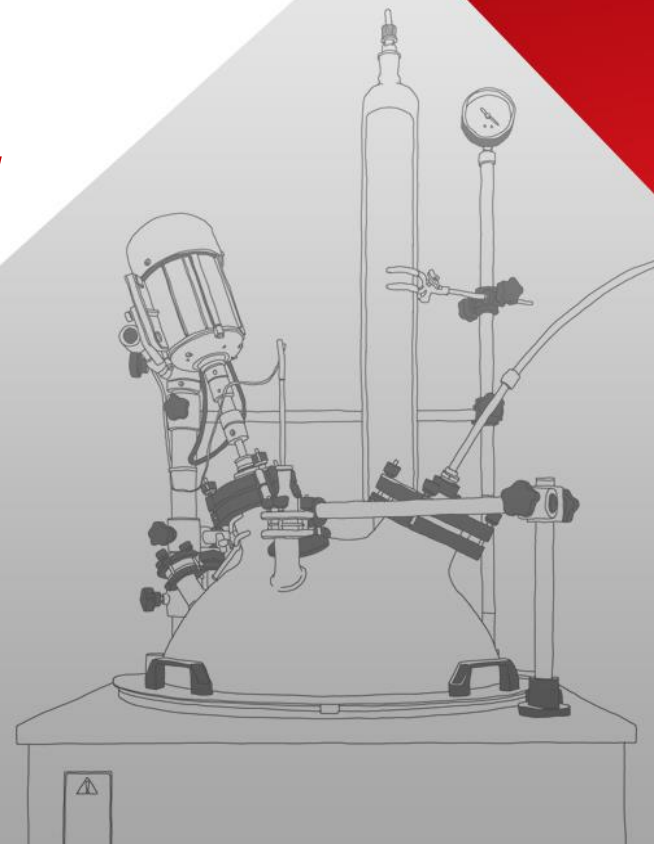
Ntrium IR

Shield-it™

We design

More than safety!



Sep. 2019

Ntrians & Advisors

S.Y. Jeong, Ph.D CEO
Samsung – Principal Engineer (Former)

J.W. Park, Ph.D CTO
Melfas (KOSDAQ) – CEO (Former)

James Lee CSO
Samsung – Principal Engineer (Former)

J.Y. Lee COO
Melfas – General Manager (Former)

Y-H Kim, Ph.D R&D T/L
Changsung – R&D Team Leader (Former)

H.K. Joe Sales/New Biz.
Ink Tech(Kosdaq) – R&D, Sales (Former)

K.S. Joo, Ph.D FAE/Planning P/L
Seoul National Univ., Seoul Semicon.

Y.M. Cho HR/Finance/Planning T/L
Daesung Group, IAMCOMPANY –HR/Planning

J.W. Hwang Paste Expert Engineer
Dongjin Semichem – Paste Expert Engineer

K.J. Lee Paste Expert Engineer
Changsung – Paste Expert Engineer

Y.K. Kwak Investor / Advisor
PwC Korea – Board Member (VP)

S.H. Kang Investor / Advisor
Cosine Investment - CEO

J.K. Kwon, Ph.D Investor / Advisor
Verdiani Inc. - CEO

K.D. Jeong Investor / Advisor
Gaon Chips Inc. - CEO

C.S. Seo Investor / Advisor
STC Inc. - CEO

B.M. Ahn (MBA) Investor / Advisor
Open Bizlab – CEO, Daum (Former)

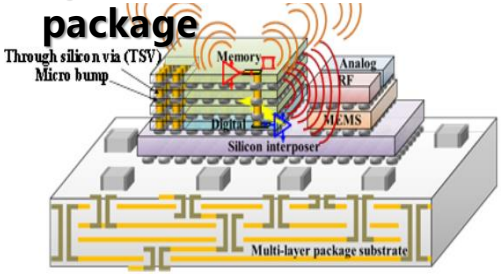
S.W. Kang Sales VP
Orbotech – Sales Director/Engineer

电磁波(EMI) 问题

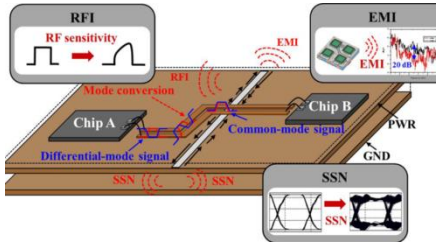
Malfunction

→ 引起设备不正常运行

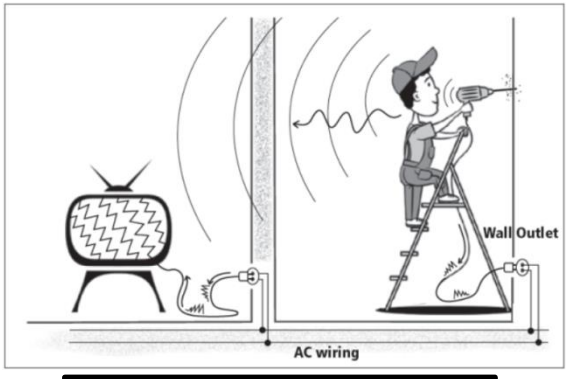
1) Inside semicon. package



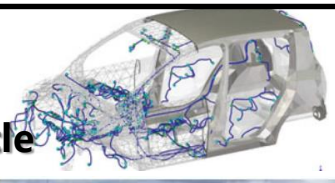
Package to package



2) System level



Adapted from : NTU EMC Group



3) Accidents in autonomous vehicle

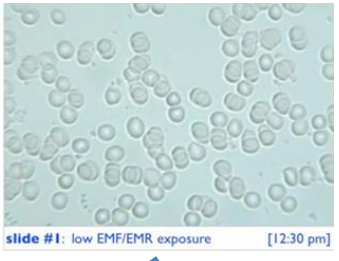
Self-driving car crash in Arizona: Waymo van involved in Chandler

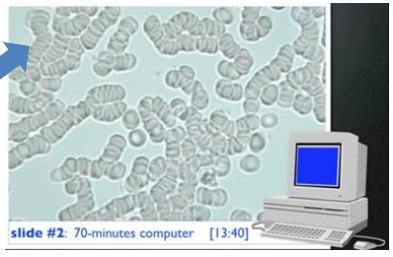
Tesla Says "Autopilot" Was Engaged During F...

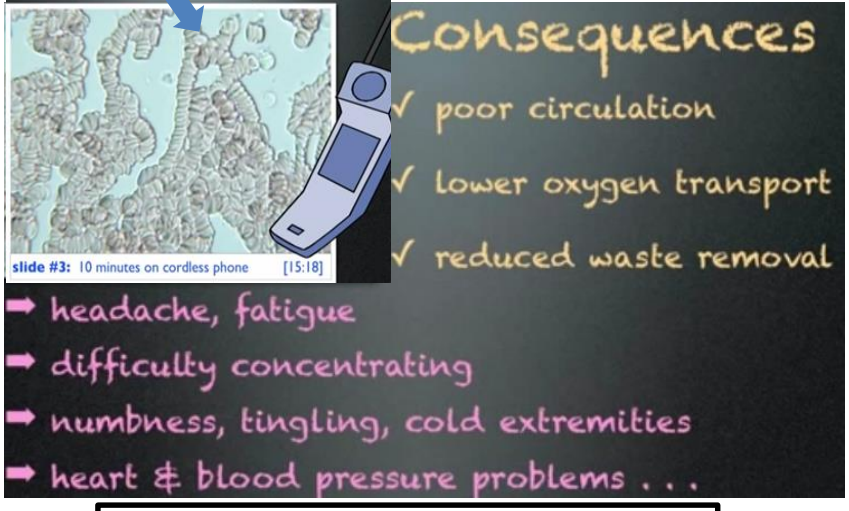
Harmful to Human

→ 导致红细胞凝结，扰乱离子流

→ 引发健康问题







Adapted from : Dr. Magda Havas, Trent Univ.

最近关于电磁波的话题

5G is coming : *Both problems!*

5G时代将产生更多RF-EMF.
RF-EMF已被确定为对人体有害

EU 5G Appeal – Scientists warn of potential serious health effects of 5G

In an appeal to the European Union, more than 180 scientists and doctors from 36 countries warn about the danger of 5G, which will lead to a massive increase in involuntary exposure to electromagnetic radiation. The scientists urge the EU to follow Resolution 1815 of the Council of Europe, asking for an independent task force to reassess the health effects.

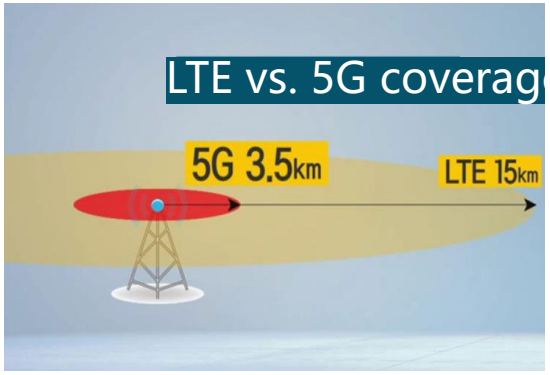
"We, the undersigned scientists, recommend a moratorium on the roll-out of the fifth generation, 5G, for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry. 5G will substantially increase exposure to radiofrequency electromagnetic fields (RF-EMF) on top of the 2G, 3G, 4G, WiFi etc. for telecommunications already in place. RF-EMF has been proven to be harmful for humans and the environment."

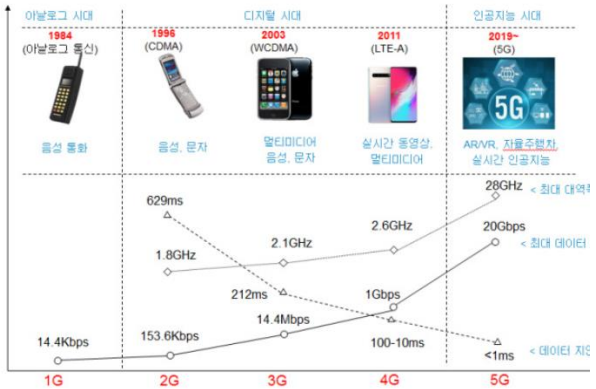
Link to the full-text PDF

Go to the website

环境部，停止向未通过电磁波认证的电摩托发放补助

李昌浩记者 ych@kihoilbo.co.kr 2019年04年04日 周四 第七面





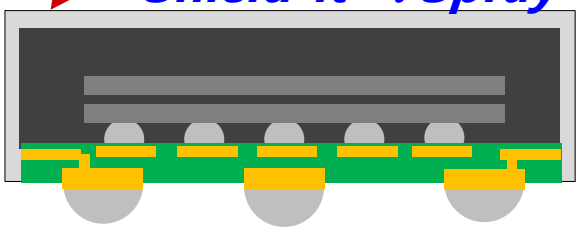
Adapted from : KAIST

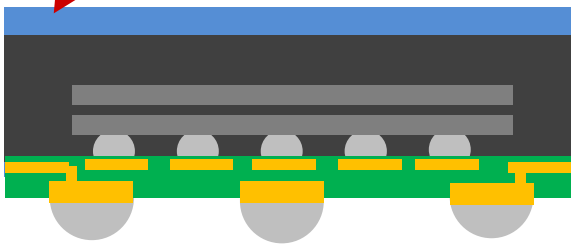
电磁波屏蔽材料,方案

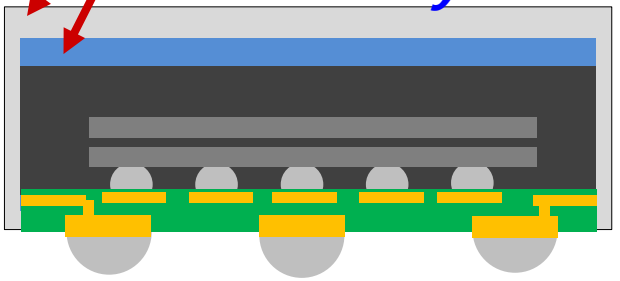
- **不同电磁波频率的分类方案 (半导体电磁波屏蔽技术居全球首位)**

全球首家，正在申请多项专利

高频 (EMI Shielding)	低频 (EMI Absorption)	高频及低频 (Hybrid : Shielding + Absorption)
(30MHz~100GHz)	(100kHz~30MHz)	(100kHz~100GHz)
Shielding Layer (By Spray Coating)	Absorption Layer (By Sheet)	Two layers (Shielding + Absorption)
Shield-it® : Spray	***Shield-it® : LowF***	***Shield-it® : Hybrid***







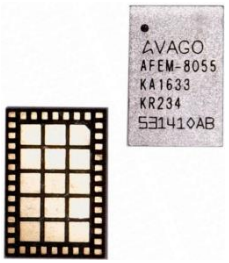
NAND, SSD, RF (LTE, WiFi)

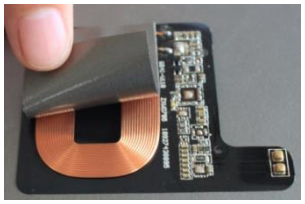
- Required technologies
  -. Spray + compartment shielding

[NAND, SSD]

Power Amplifier, Wireless Charger, etc.

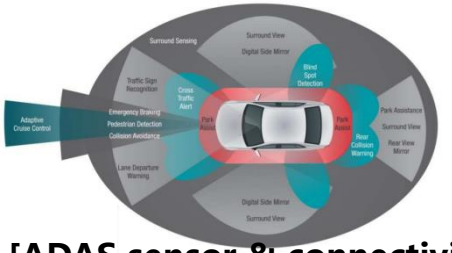
- Required technologies
  -. High permeability magnetic material
  -. Lamination technology





Wide-band EMI shielding solution

- Required technologies
  -. Highly conductive solutions
  -. High permeability material development

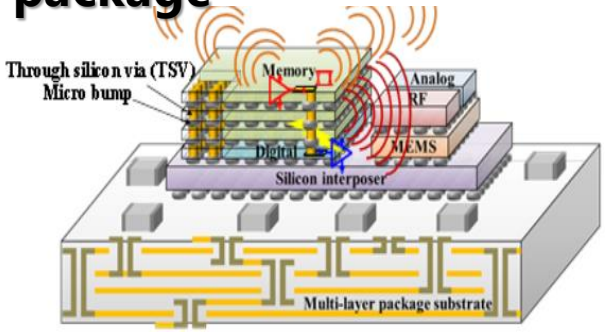


[ADAS sensor & connectivity]

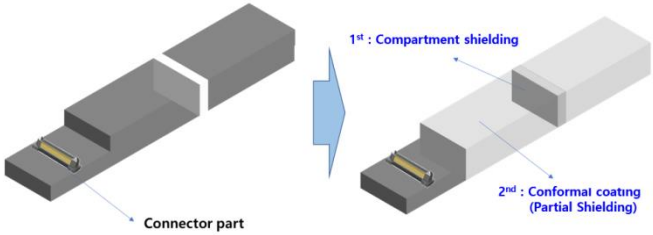
电磁波屏蔽材料, 方案

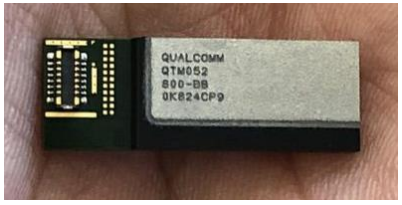
- **根据电磁波源构造和形状的分类方案**

Inside semicon. package



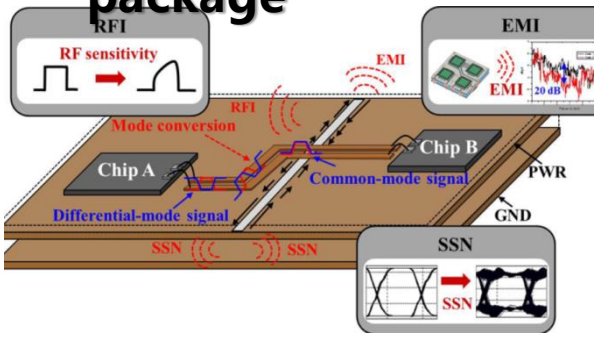
Shield-it® : Trench Fill



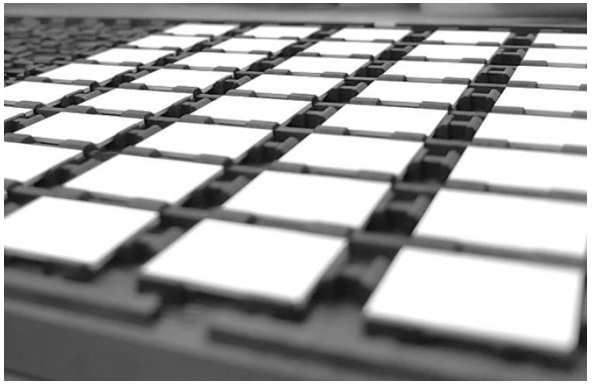


[adapted from : Qualcomm]

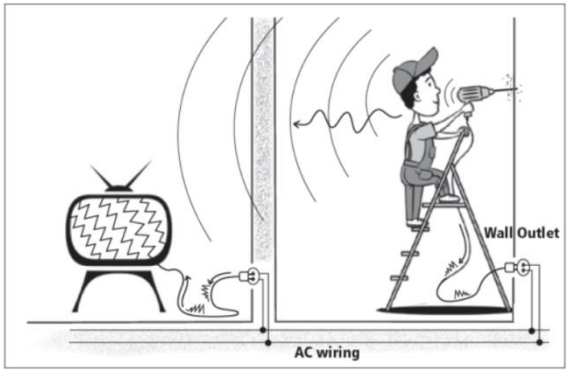
Package to package



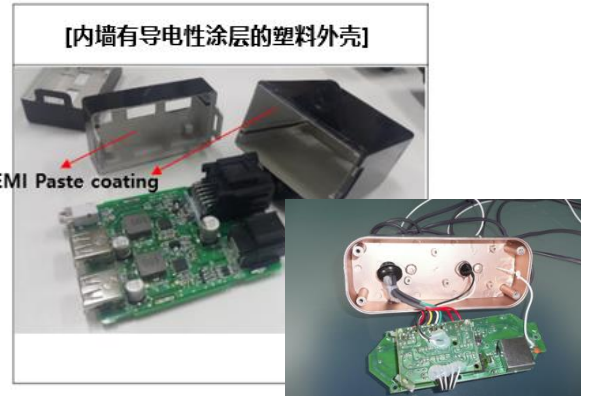
Shield-it® : Spray



System level



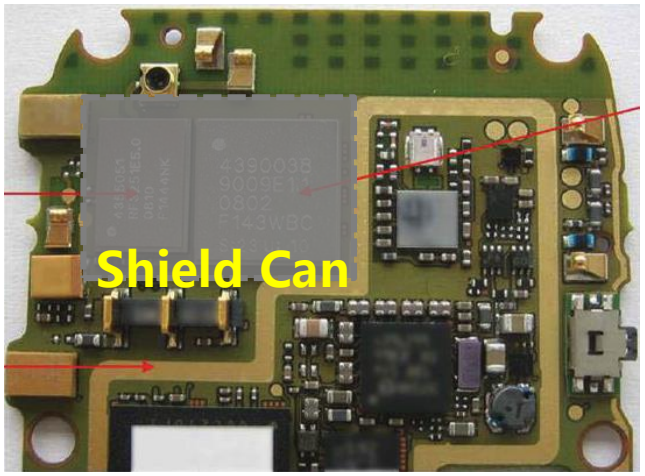
Shield-it® : Spray



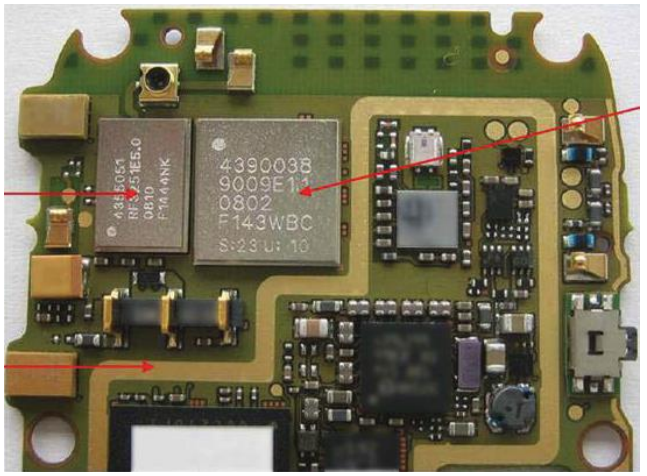
现有方式 VS. 喷雾方式

'Board-level EMI 屏蔽技术'
→ *'shield-can'*
- 缺点: 集成度↓, 设计自用度↓等

'封装级 EMI 屏蔽技术'
→ 'conformal coating'



Board-level Metal Lid Shielding



Package-level Conformal Shielding

Application	RFMD Transmit + Transreceiver module		
Shielding	Shield-can	-	Conformal coating
Board Area	301mm^2	**42% smaller**	175mm^2
Total Height	1.8mm	**33% thinner**	<1.2mm
Material Cost	$0.2USD	**64% lower**	$0.07 USD

Source : T. Kawamura, Package Trends for Mobile Device : On-package EMI Shield At CTEA Symposium, TEL NEXX, Inc., Feb-10, 2015

喷雾：敷形涂覆方式中的最佳方式

	喷雾	溅射	电镀
材料	**导电性材料:** Ag, Ag/Cu **器材:** Epoxy, Silicone, Acryl	**导电性材料:** Cu, SUS, Ni	**导电性材料: 电解** Cu, Ni
膜厚度	0.1 um 1 um 10 um 100 um	0.1 um 1 um 10 um 100 um	0.1 um 1 um 10 um 100 um
纵横比	0.8 ~ 1	0.1 ~ 0.5	1
工序时间	短	长	长
工序费用	低	高	高
生产率	高	低	低
电阻	优秀	优秀	优秀

汽车电装塑料外壳内部敷形涂覆:
喷雾具有独创的易操作性，量产性，成本竞争力

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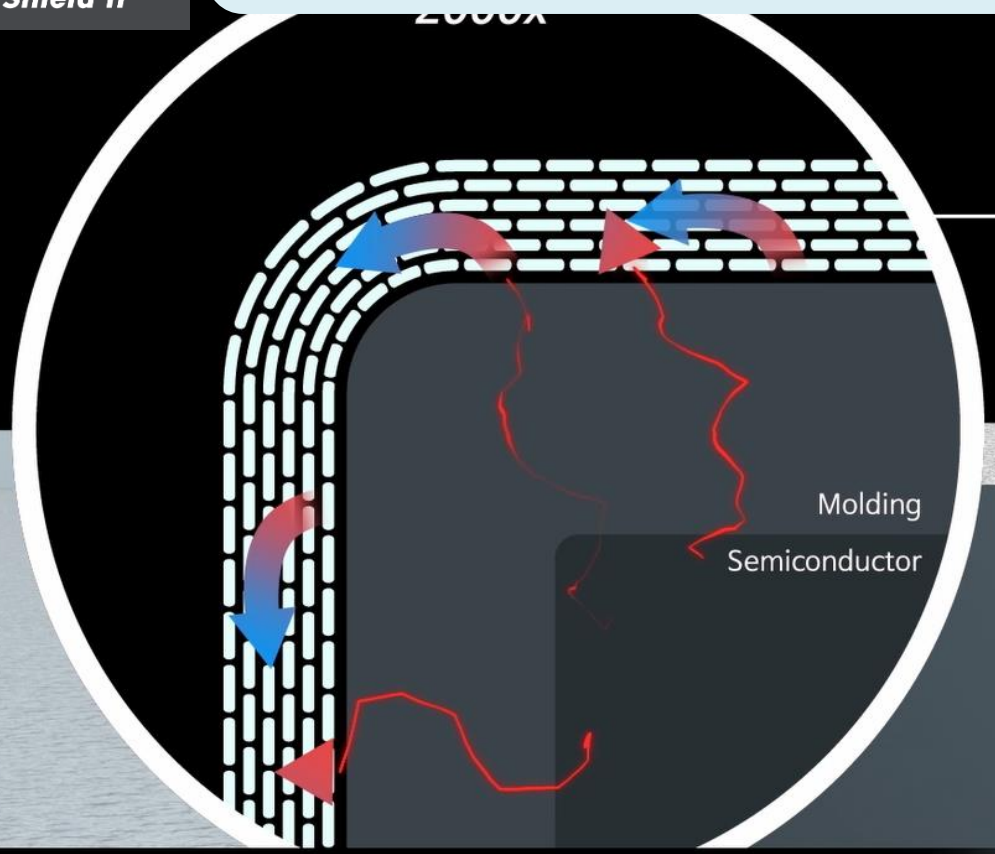
Ntrium的技术竞争力1: 高频电磁场屏蔽喷雾材料

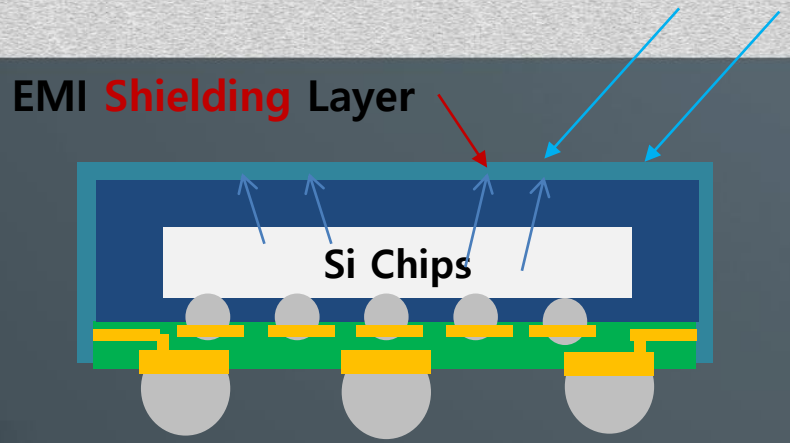
Ntrium

Shield-it®

World 1st approved for mass production for semiconductor packages



Multiple layers of thin flake-like particles block every path of electromagnetic waves



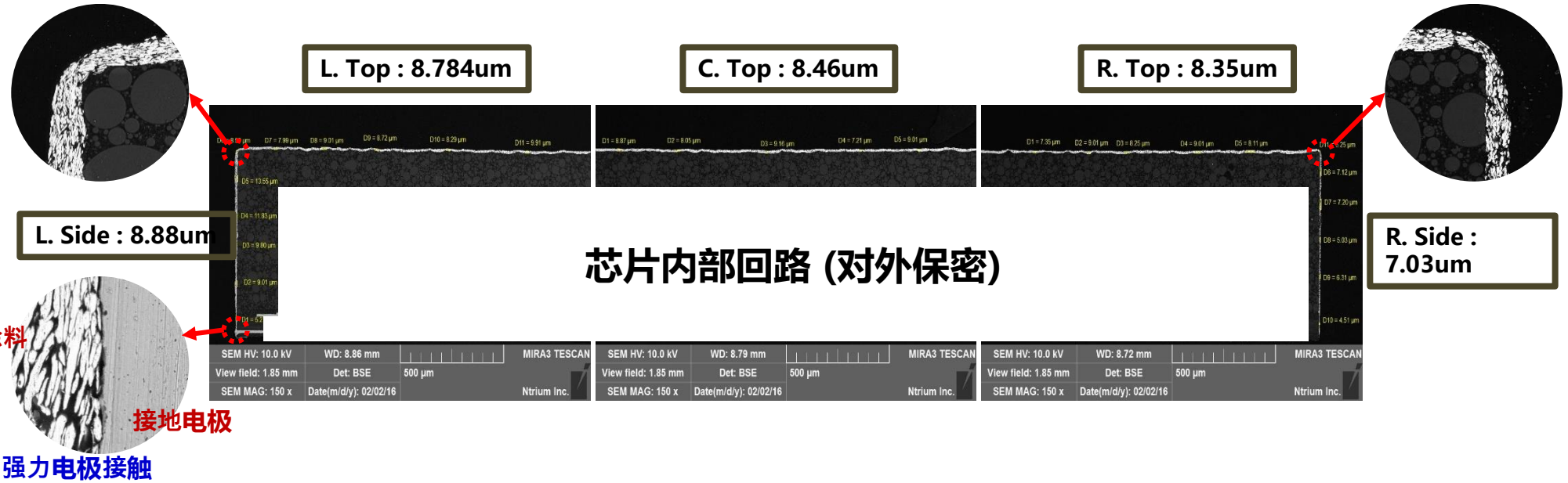
Semiconductor package

*Patented Technology : ingredients, composition and filler shapes

确保薄且均匀的喷雾涂层

- **需要尖端素材技术集约: 导电性离子, 黏合剂, 溶剂, 添加剂, 分散, 配合等**
  - 平均镀层厚度 : 8um, 上面 : 7 ~ 9 um, 侧面 : 7 ~ 9um
  - 电阻率 : $3x10^{-5}\Omega\cdot cm$, 链电阻 : 40mΩ
  - 上方/侧面厚度比例 : 70~100%

涂料	内容	干燥条件 (℃/min.)	厚度 (左侧面)	厚度 (上面)	厚度 (右侧面)	电阻率(Ω·cm)	菊花链电阻(Ω)
NES-F3-series	EMI Paste + 稀释剂 (1:0.5)	190/30	8.88um	8.53um	7.03um	$3x10^{-5}\Omega\cdot cm$	40mΩ



可信性，试验前后均衡的屏蔽特性

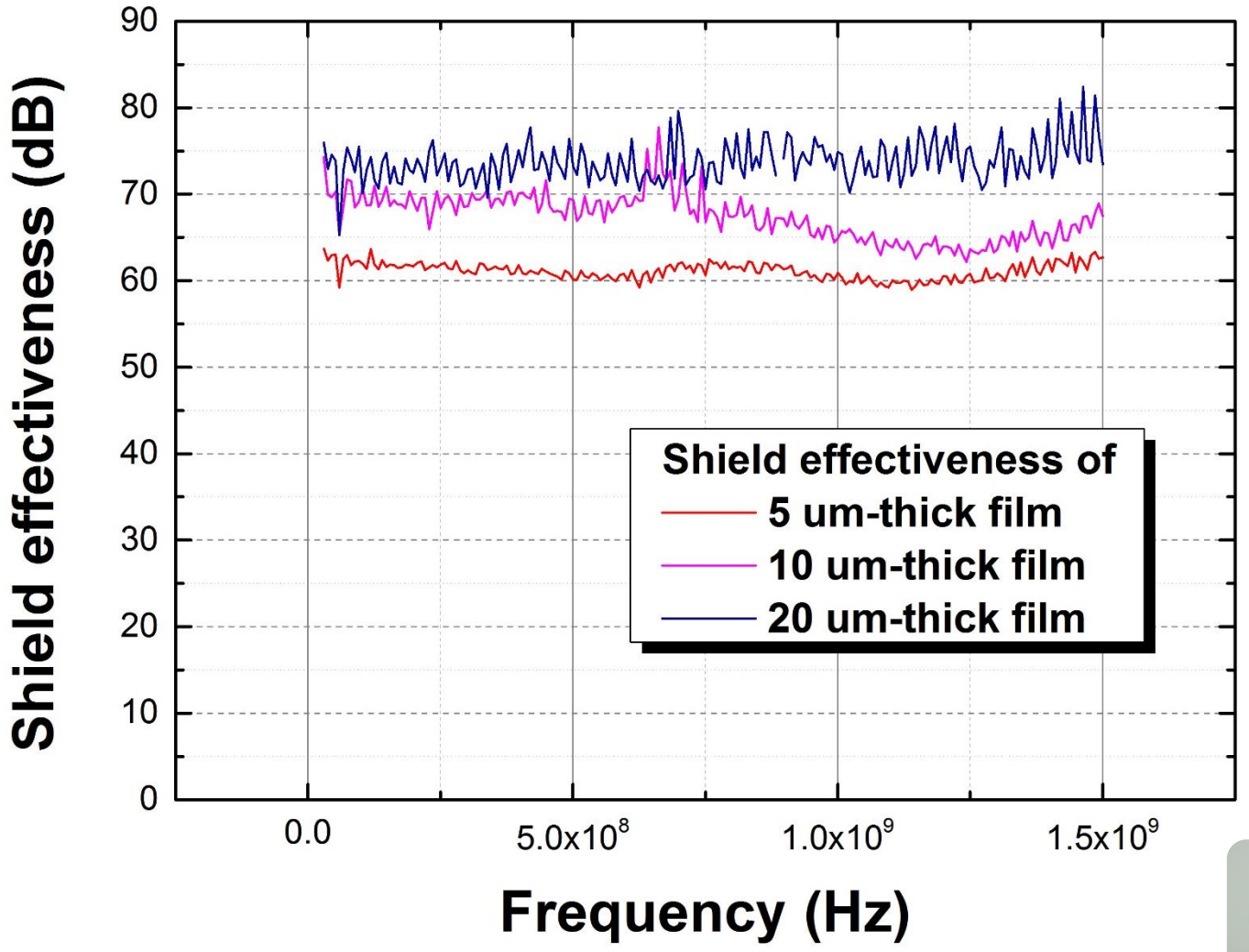
SPL No.	Resistance (Ω)	SPL No.	Resistance (Ω)	SPL No.	Resistance (Ω)
1-1	0.048	2-1	0.046	3-1	0.043
1-2	0.045	2-2	0.042	3-2	0.046
1-3	0.042	2-3	0.043	3-3	0.046
1-4	0.045	2-4	0.043	3-4	0.045
1-5	0.046	2-5	0.044	3-5	0.044
1-6	0.047	2-6	0.045	3-6	0.047
1-7	0.045	2-7	0.046	3-7	0.048
1-8	0.046	2-8	0.045	3-8	0.043

85℃ 85% RH, 0hr

SPL No.	Resistance (Ω)	SPL No.	Resistance (Ω)	SPL No.	Resistance (Ω)
1-1	0.044	2-1	0.048	3-1	0.045
1-2	0.043	2-2	0.044	3-2	0.044
1-3	0.043	2-3	0.046	3-3	0.044
1-4	0.046	2-4	0.042	3-4	0.046
1-5	0.046	2-5	0.046	3-5	0.043
1-6	0.045	2-6	0.046	3-6	0.045
1-7	0.045	2-7	0.044	3-7	0.047
1-8	0.043	2-8	0.044	3-8	0.043

85℃ 85% RH, 196hrs

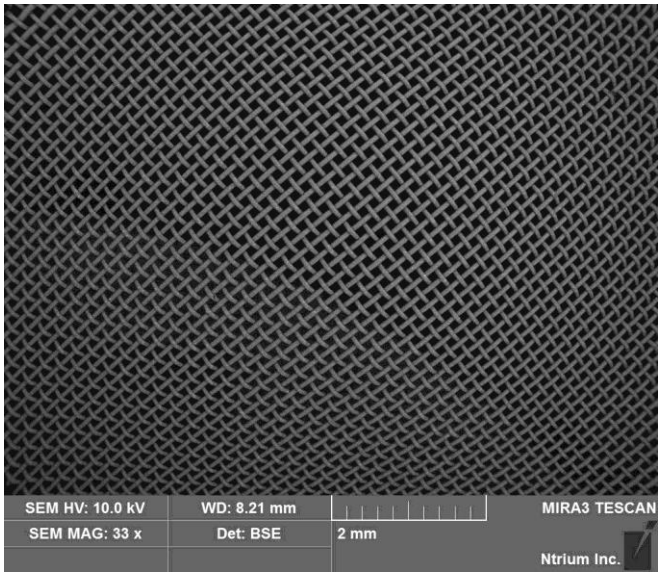
薄膜的高电磁波屏蔽特性

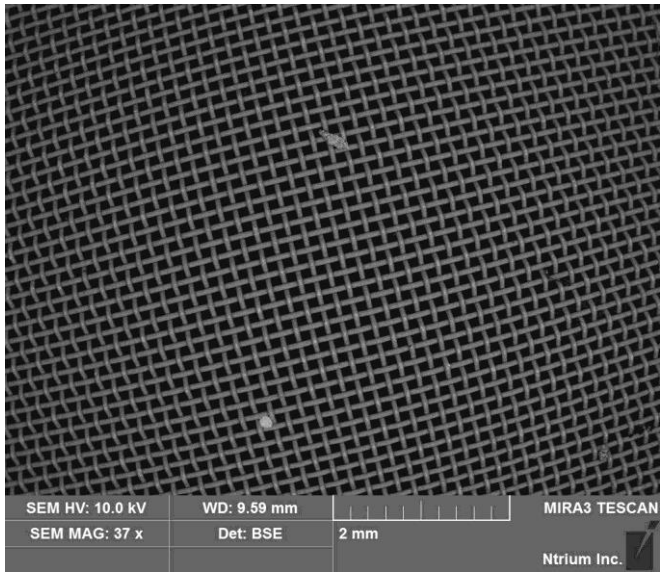


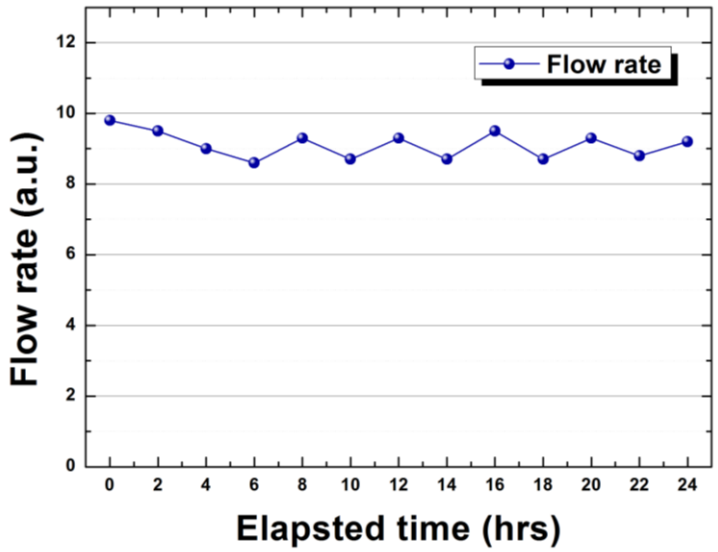
- 测定方法: Agilent E5062A (ASTM 4935 standard)

量产时稳定性 (Chemical Stability)

- Procedure : Flow Rate and Filtration Test for 24h Spraying Process







- Result : Passed
  - Flow rate : 8.7~9.7 (spec. 7 ~ 11)
  - Filtration : No Issue for Mass production

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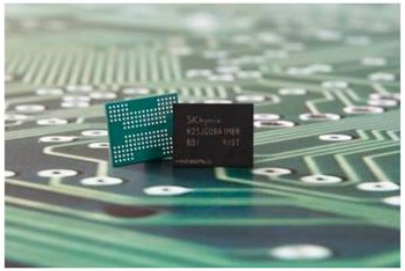
选定为技术革新企业 / 获得总统奖表彰

- SK集团共生协力项目一环
- 在最先选定的3个公司中唯一被选为材料公司 → 新概念 EMI材料
- **世界第一个获得EMI 喷雾方式应用于半导体用量产认证，且是唯一材料**
- **在与日本T企业, 美国H企业的技术竞争中取胜**

秒懂SK HYNIX 喷雾方式的电磁波屏蔽NAND FLASH

发布日期:2019.05.16

[AD] 罗姆-高速二极管内置600V电压 Super Junction MOSFET



SK HYNIX 96层 4D NAND 基础 1Tb QLC 产品 <图片-SK HYNIX>

SK HYNIX开始实施应用电磁波屏蔽新技术- NAND FLASH的量产. 这种新的屏蔽技术是' 喷雾' 封装方式. 与现有的屏蔽方式相比，喷雾方式可以屏蔽侧面漏出的高频和低频电磁波. SK HYNIX 将NAND FLASH扩展应用到了D-RAM的产品群.

SK HYNIX 公布了新的共生合作项目，将挑选高技术潜力的合作企业作为" 技术新企业" 进行集中培养. SK HYNIX 一直在运营共同发展协会，专利转让，共同发基金等合作伙伴支援项目.此次项目的支援重点即为挖掘技术革新企业，又称强小业，并培养它们的全球竞争力.SK会长Choi Taewon将按照指示进行全力支援.

[2018年风险创业振兴有功者表彰]
[获得总统表彰]

Ntrium的技术竞争力 2: 同时屏蔽低频/高频的新材料技术

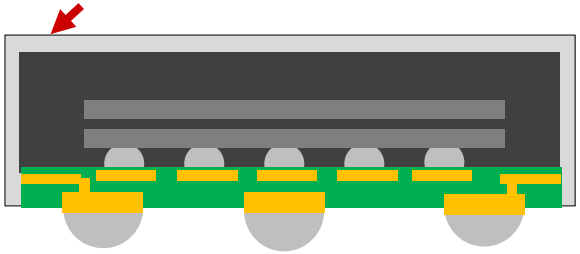
- **不同频率范围的电磁波屏蔽方案**

全球首家，正在申请多项专利

高频 (EMI Shielding)

(30MHz~100GHz)

Shielding Layer
(By Spray Coating)



NAND, SSD, RF (LTE, WiFi)

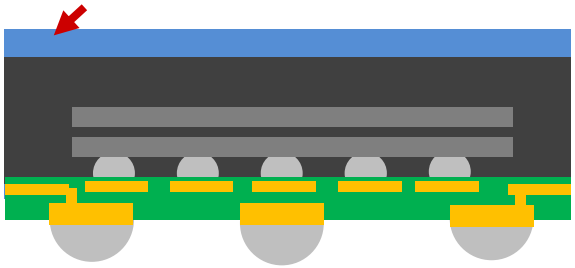
- Required technologies
  -. Spray + compartment shielding

[NAND, SSD]

低频 (EMI Absorption)

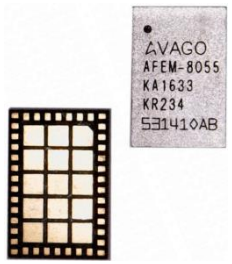
(100kHz~30MHz)

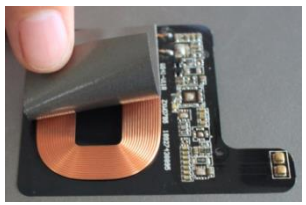
Absorption Layer
(By Sheet)



Power Amplifier, Wireless Charger, etc.

- Required technologies
  -. High permeability magnetic material
  -. Lamination technology

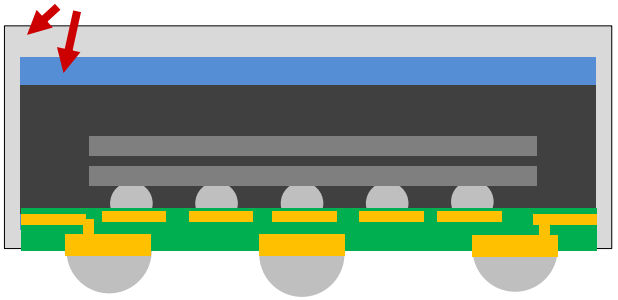




高频及低频 (Hybrid : Shielding + Absorption)

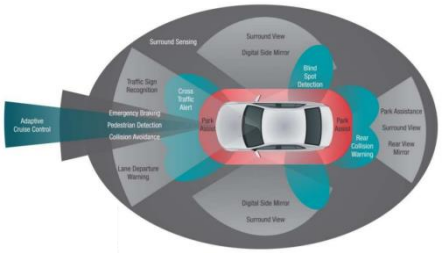
(100kHz~100GHz)

Two layers
(Shielding + Absorption)



Wide-band EMI shielding solution

- Required technologies
  -. Highly conductive solutions
  -. High permeability material development



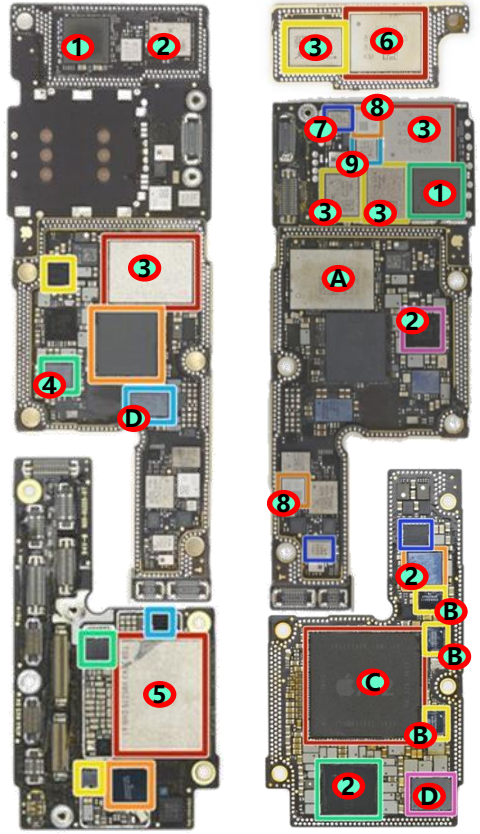
[ADAS sensor & connectivity]

手机半导体市场

- **潜在市场规模：低频屏蔽材料– 69亿RMB, 高频屏蔽材料– 228亿RMB**

- 2018年手机生产量: 14亿台，每台手机半导体数量 : 70个，- 每台手机低频半导体数量 : 14个 - 半导体销售单价: 高频 0.23RMB, 低频 0.35RMB

- **短期目标市场：半导体用低频屏蔽材料→ 占有率达到14亿*14个* 0.35RMB *40% 时，最低销售额为27亿RMB, 利润率为40%以上**
- **- 高频屏蔽材料→占有率达到14亿*70个*0.23RMB*20% 时可实现46亿RMB的销售额，利润率为30%以上**



<iphone XS teardown, from : ifixit.com>

Chip #	ea	Components	Switching / Operating Frequency	Ntrium solution	Supplier
3	5	Power amplification modules	200~400KHz	Ag paste Magnetic Tape EMC	Skyworks
B	3	Audio amplifiers	240~499KHz	Ag paste Magnetic Tape EMC	
2	4	Power management IC	0.8~1.35MHz	Ag paste Magnetic Tape EMC	
D	1	Battery charger	1.5MHz	Magnetic Tape EMC	
4	1	NFC controller	3.4MHz	Ag paste Magnetic Tape EMC	NXP
5	1	Flash storage	52MHz	Ag Paste EMC	Toshiba
D	2	Wireless charging module	0.2~100MHz	Magnetic Tape EMC	Broadcom
8	2	4x4 MIMO duplexer	876.5MHz	Ag Paste EMC	
7	1	GPS low-noise amplifiers	1559~1606MHz	Ag Paste EMC	
1	2	RF transceiver	1922.4 ~ 1977.6MHz	Ag Paste EMC	
A	1	Wifi/Bluetooth SoC	2400 - 2483.5MHz	Ag Paste EMC	
C	1	AP	1590MHz, 2500MHz	Ag Paste EMC	SK Hynix
9	1	RF switch	20MHz~6GHz	Ag paste Magnetic Tape EMC	

主要竞争对手

Henkel Adhesive Technologies Products Services Industries Insights Search fo

Component Level Electromagnetic Interference (EMI) Shielding Solutions

Reliable shielding and adhesion performance in stressful electronic conditions and environments

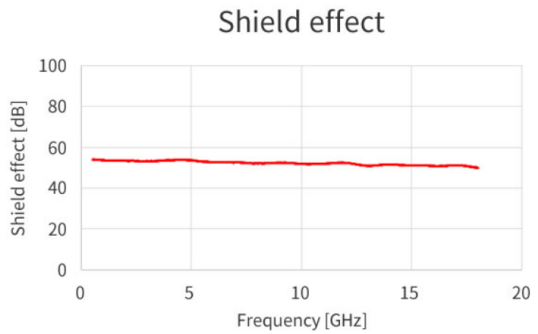
Henkel's specialized materials, designed to be applied at the package level, have optimal properties and characteristics that provide reliable shielding and adhesion performance in stressful electronic conditions and environments.

Our compartmental shielding materials portfolio showcases adaptable designs for internal component-to-component shielding with in-package partition, while our conformal shielding materials provide for external package-to-package shielding with an outer coating layer.

Henkel's flexible material formulations not only mean more reliability and greater functionality, but ensure innovations that deliver more scalable processes, higher production throughput (UPH) and a lower cost of implementation for EMI shielding solutions.

NAMICS INSIGHT Product R&D example cases News Company Info | LANGUAGE

The coating is cured at 150 deg.C / 60 minutes and has a high shielding effect more than 50 dB with a film thickness of 10 um or less. Also, by optimizing spray onditions, it is possible to form a very uniform coating on both the top and side surfaces.
It has a work life of 24 hours or more and excellent workability even without utilizing a stirring device.
In addition, customization is possible to accommodate various types of spray equipment and applicatio conditions. Please contact us to consult with you and to provide samples designed for your application.



MG Chemicals chemical products Powered by Google Translate Search...

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You are here: / Home / Products / EMI / RFI Shielding

EMI / RFI Shielding Catalog

Comparison Chart
Effectiveness Chart
Acrylic Application

EMI AND RFI SHIELDING

MG Chemicals offers a range of conductive paints for EMI/RFI shielding and related applications.

- Acrylic is the most common. It is widely used on electronic enclosures, satellite dishes, and board level applications. It is easy to apply, durable, and adheres well to many surfaces.
- Water Based Urethane is the only choice in architectural applications because of its low VOC content. It is non-flammable, has no noxious vapors, and is not a dangerous good by air.
- Epoxy is used when extreme durability is needed. It offers mar and scratch resistance, very strong adhesion, extreme abrasion resistance, impact resistance, and strong chemical resistance.

DUPONT The miracles of science

Select Product Family - Select -

Display Materials

DuPont Canada Home » Products & Services » Via Fill Paste & Shielding Materials

- Color Filters
- Display Circuit Materials
- Electroluminescent Materials
- Via Fill Paste & Shielding Materials

Via Fill Paste & Shielding Materials

DuPont Electronics offers a wide array of new copper-based products and a new carbon product for rigid circuit boards and flexible circuits. This

Helpful Links

- Agriculture
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- Electronics
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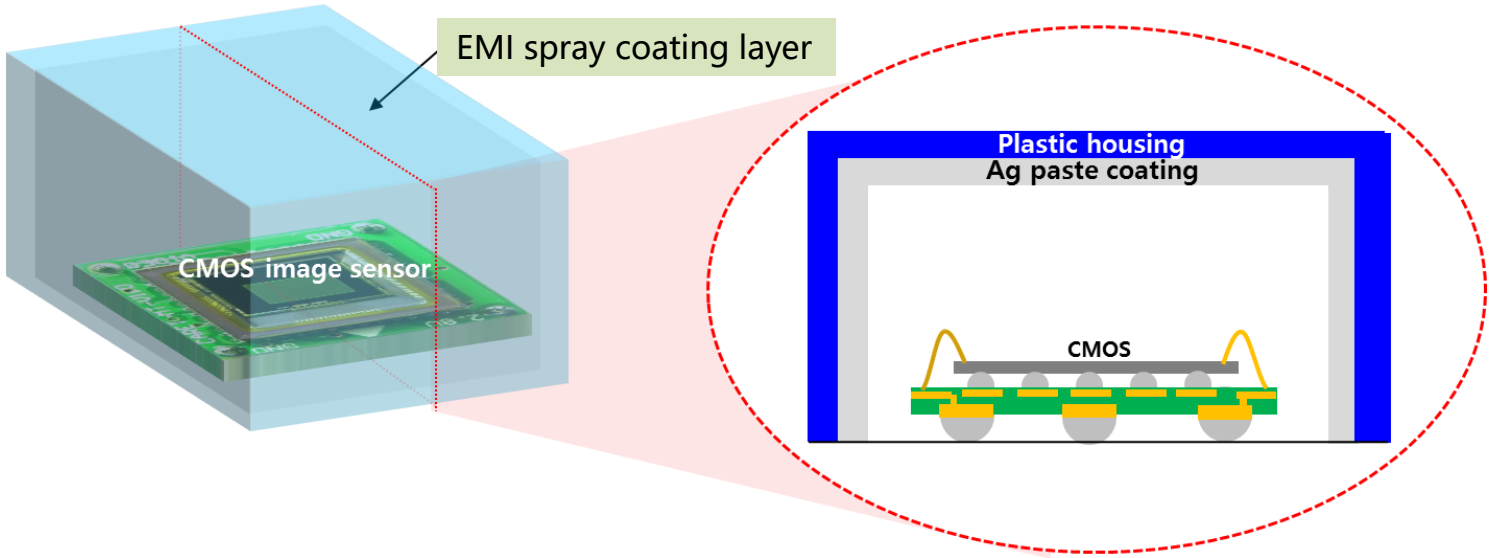
- Government

今后 Big market：汽车电装外壳的电磁波屏蔽

- 在塑料外壳内侧做导电性喷雾涂层

[塑料外壳内部涂层]



[塑料外壳喷雾涂层示意图]

- 代替现有的金属外壳 (开发中)：轻量化(>50%) + 降低成本(>30%)

Market Size 及今后销量预测

- 电磁场屏蔽素材零件市场 : 约 410亿RMB(’ 18)

→ 由于ADAS, 自动驾驶汽车, 5G市场增长等因素，市场规模在持续扩大

($MILLION)

屏蔽方式	2013年	2014年	2019年	年均增长率(%) (2014-2019)
导电性涂层材料	1,937	1,981	2,359	3.6
金属壳	776	793	993	4.6
导电性塑料	520	539	657	4.0
层压/胶带/箔	228	238	302	4.9
其他	1,742	1,802	2,314	5.1
合计	5,203	5,353	6,625	4.4

- 当前目标市场 (包括将来扩展市场)

- 智能手机用半导体: 300亿RMB * 30% = 90亿RMB
- 汽车电装半导体 : 1亿台 * 1,000个/大 * 0.6RMB * 50% = 300亿RMB
- 汽车电装外壳 : 1亿台 * 100 housings * 2.9RMB * 30% = 870亿RMB

→ 上述目标市场的占有率达到20%时，预测销售额为94亿RMB，利润29亿RMB

- 今后销售预测 (预计利润率为30~40% 左右)

: 290万RMB(’ 19) → 2,900万RMB(‘20) → 8,730万RMB(‘21) → 3.5亿RMB(’ 22) → 8.7亿RMB(‘23)

Ntriums 贴膜产品及销售市场计划

- 智能手机贴膜市场及销售市场计划

- 后盖市场：每年约18亿RMB市场. 已完成中国市场认证. 290万RMB(’19), 5,820万RMB(’20年)
- 防爆膜：每年约6亿RMB市场.已完成中国市场认证. 1,160万RMB(’19), 5,820万RMB(’20年)
- PU保护膜：全球每年约35亿RMB市场. 正进行中国市场认证. 580万RMB(’19), 1.2亿RMB(’20年)
- 导电复合膜：全球每年市场规模约为5亿RMB.已完成中国市场认证. 580万RMB(’19), 2,300万RMB(’20年)

- 大中华地区：销售/市场扩展中, 持续确保客户增加
- 越南：与Vin smart合作中. 与Back cover film合作并计划明年开始向其供货
- 国内：向S企业供货，计划增加产品群供货量

销售额及IPO计划

- 申请科斯达克上市审查 (’ 21, 5月) → 技术上市或SPAC上市

☞ 已选择指定咨询处(新韩金融投资)，并商议日程及计划

(单位：万元RMB)

产品名称	去年业绩	2019年			2020年			2021年		
		内需	出口	小计	内需	出口	小计	内需	出口	小计
电磁波屏蔽材料	25	185	106	291	1,047	1,862	2,909	2,618	6,110	8,728
功能膜材料	1,673	140	3,352	3,491	320	8,408	8,728	4,073	7,564	11,637
导电性粒子	406	355	70	425	401	93	495	431	122	553
Roll to Roll Press	-	320	524	844	465	640	1,106	582	873	1,455
其他	1,551	3,677	-	3,677	4,189	-	4,189	4,364	-	4,364
合计	**3,655**	**4,677**	**4,051**	**8,728**	**6,424**	**11,003**	**17,427**	**12,068**	**14,669**	**26,737**

Shield-it®

We design
More than safety

Thank you!