

DOTITE

Materials With High Magnetic Permeability For RFID And Automotive Battery Case Applications

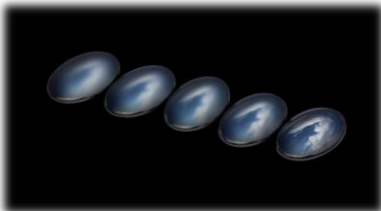


David Dewey
Electronics Materials Division
Marketing Department

Business Units of Fujikura Kasei



Automotive Interior/Exterior
Cosmetics, Mobile Phone, Accessories



Printed Electronics
EMI Shielding
Conductive Paint,
etc.



Electronics Materials Division

Coatings for Plastics
Division

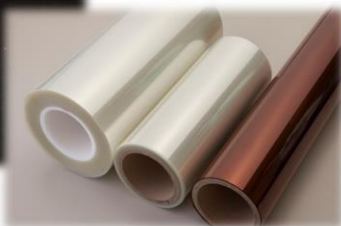
Functional Polymers
Division

Base Technologies
**Coating, Chemical,
Dispersion, Formulation**

Architectural Coatings
Division

Medical Materials
Division
Diagnostic Agent

Interior/Exterior
Housing
Public Buildings
and Facilities



Glue, Adhesive(General/Electronics)
Toner Binder, Charge Control Agent



DOTITE - History & Know-How

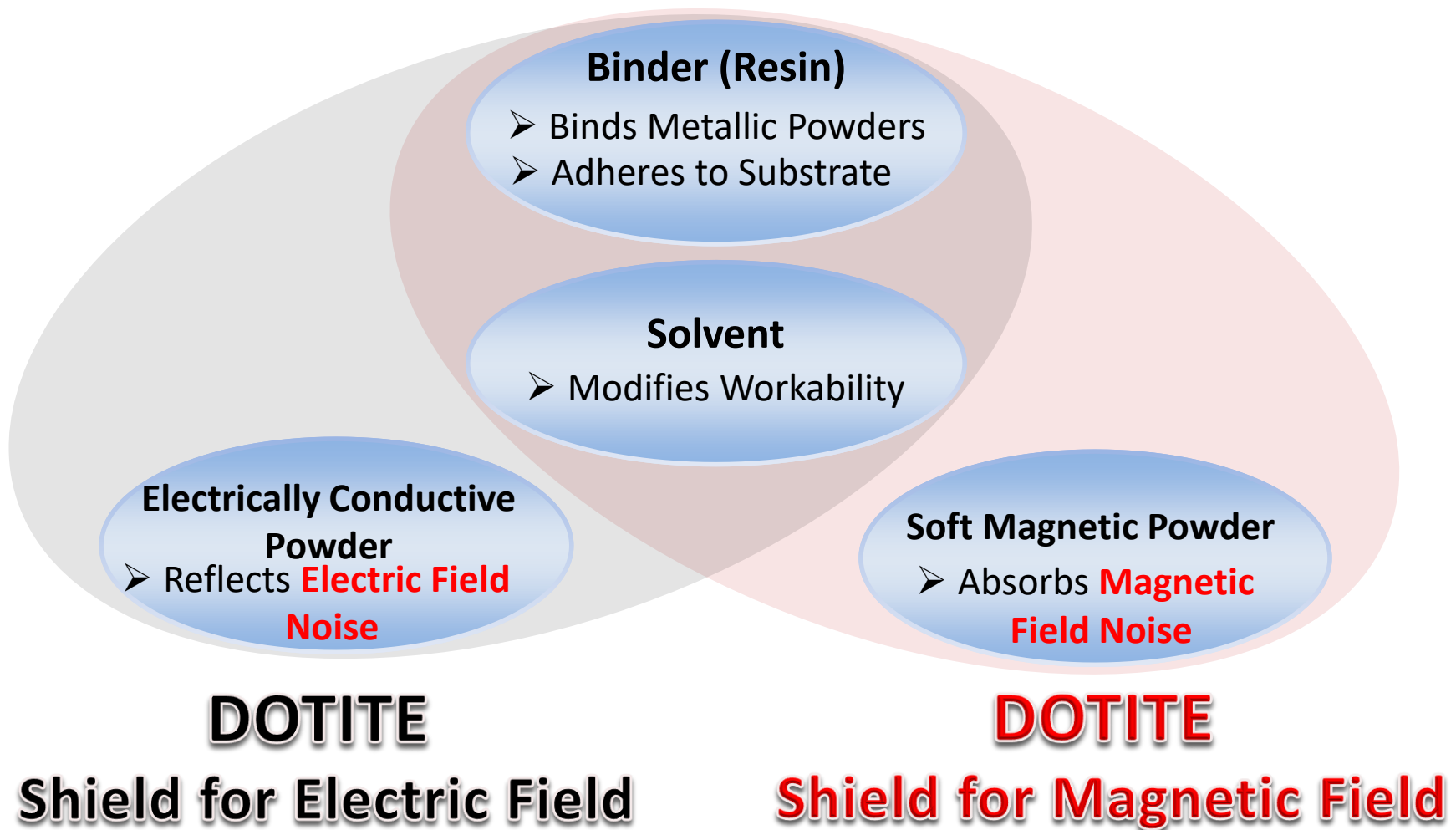
DOTITE was developed in 1957, and we were the first in Japan to manufacture and market electrically conductive pastes.

Our Expertise:

- Formulation and dispersion of resin, solvent, etc.
- Manufacturing and design of metal fillers.
- Evaluation of paste properties and characteristics of cured films; development of new materials to meet customers' requests.



DOTITE Basics



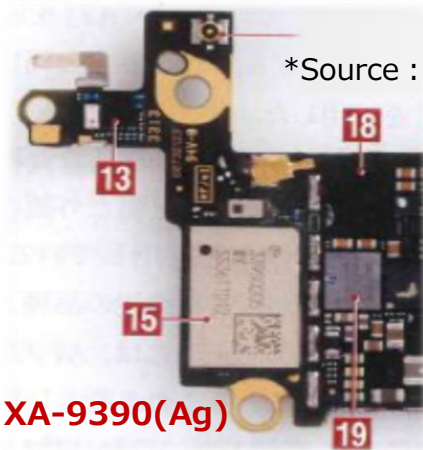
Typical Applications of EMI Shielding

Electric Field Noise Shielding

Digital camera case



Wi-Fi Module parts



*Source : Nikkei Electronics

High performance power source for audio



*Source : HONDA Website
LiB-AID E500 for Music

- Can be easily applied to complex surfaces
- Can replace metal casing with lighter material
- Can reduce size of casing, allowing thinner, smaller components.

Our Shielding Lineup

Conductive

XA-9015(Ag)



FE-107(Ag-Cu)



FN-101(Ni)



XC-12(C)

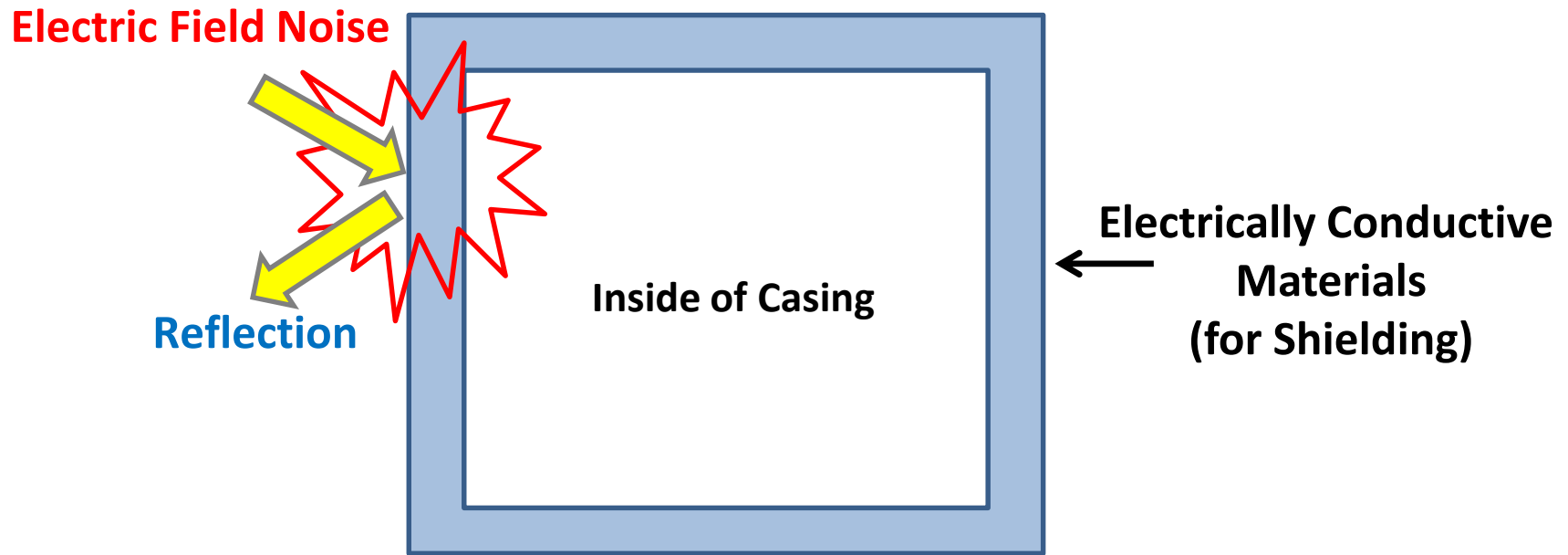


Magnetic

XO-9021(Fe-Si-Al)



Shielding Against Electric Fields

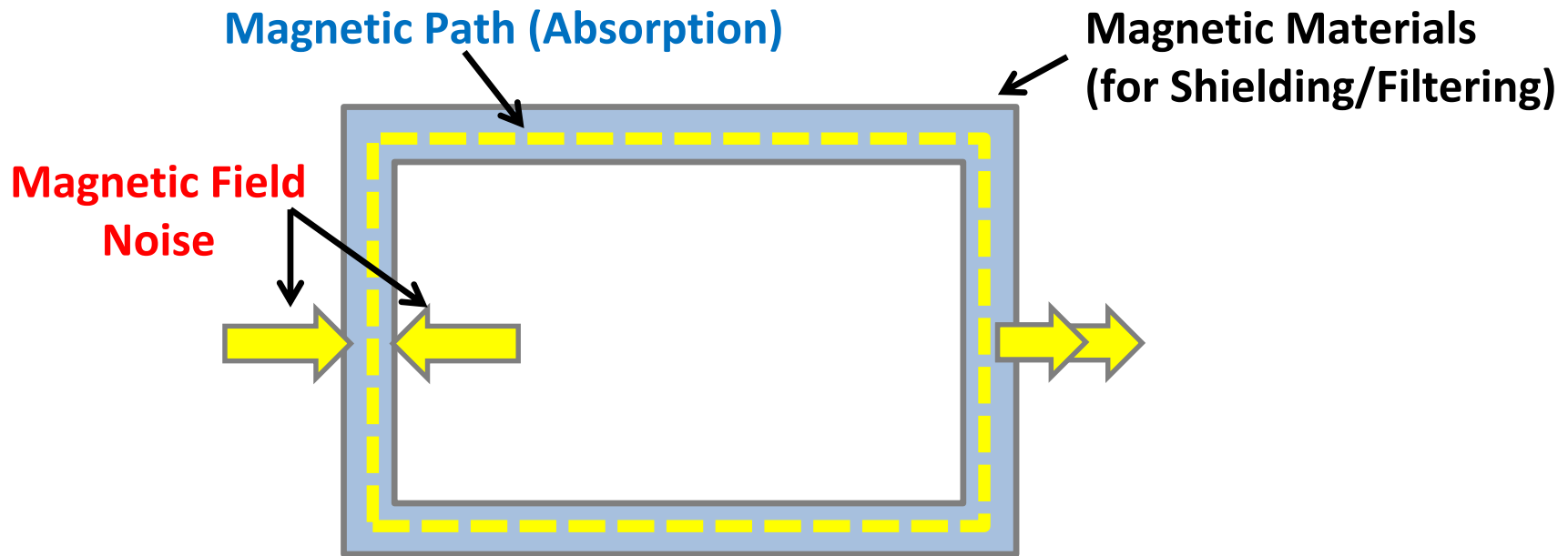


Electric field noise above 10MHz will be almost entirely reflected by electrically conductive materials, protecting the inside of casings from such interference.

Because the mechanism of an electric field noise shield is reflection, it can be effective as a thin film with less than 100 μ m thickness.

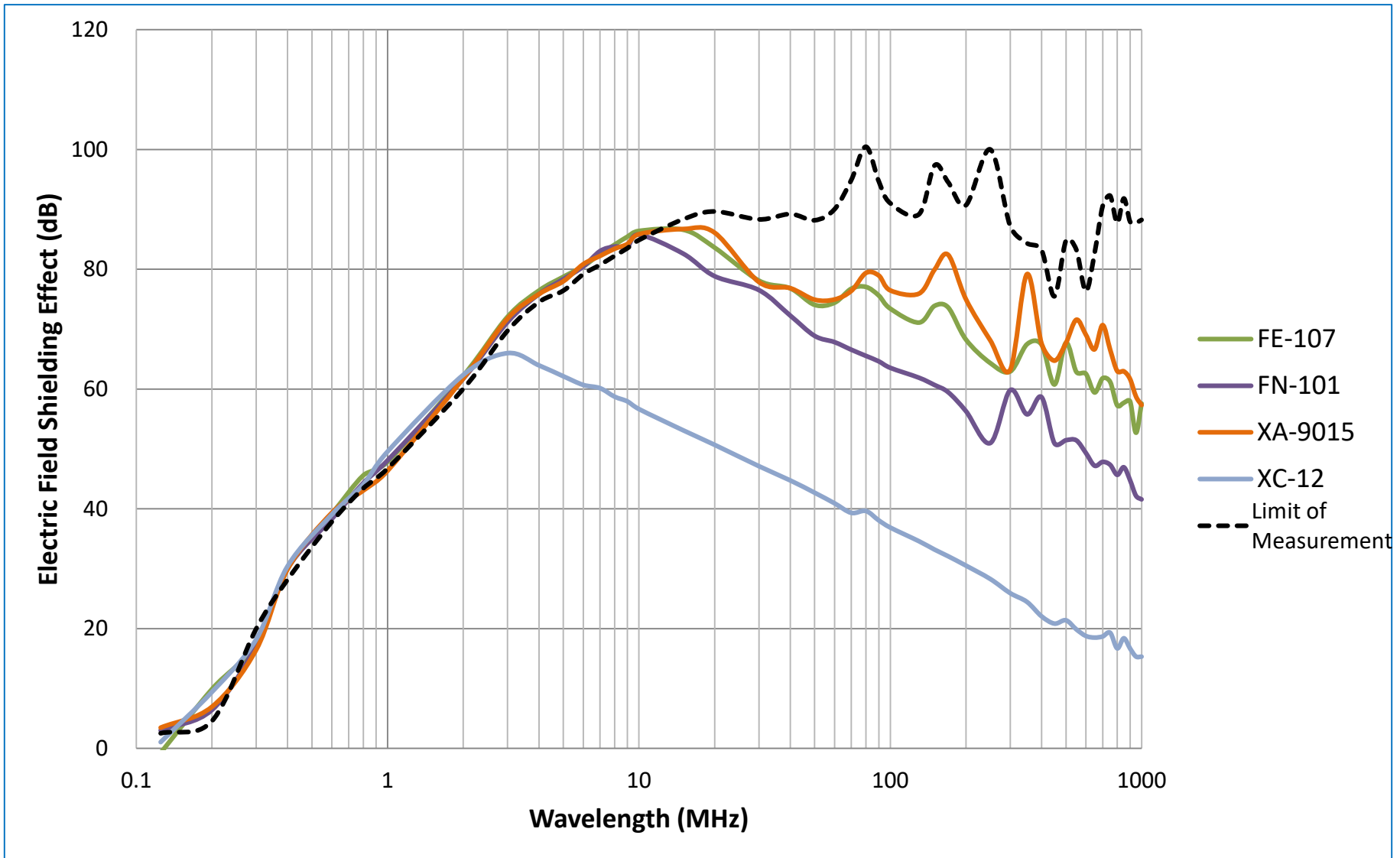
Shielding Against Magnetic Fields

A common cause of malfunction in electronics is low frequency (below 3MHz) magnetic field noise.

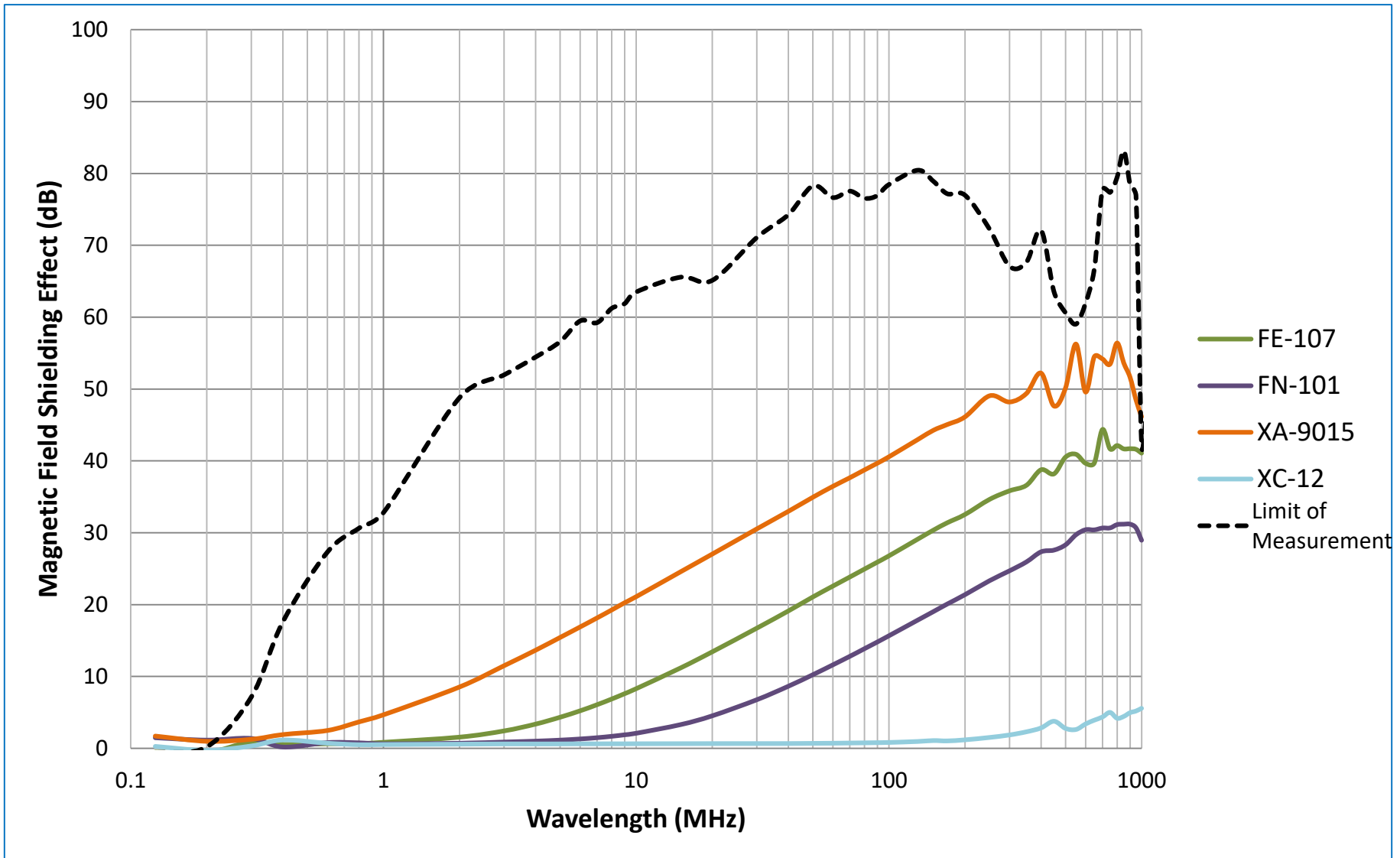


A magnetic path formed with high permeability magnetic materials to shield from magnetic field noise.

Electronic Field Shielding (KEC Method)



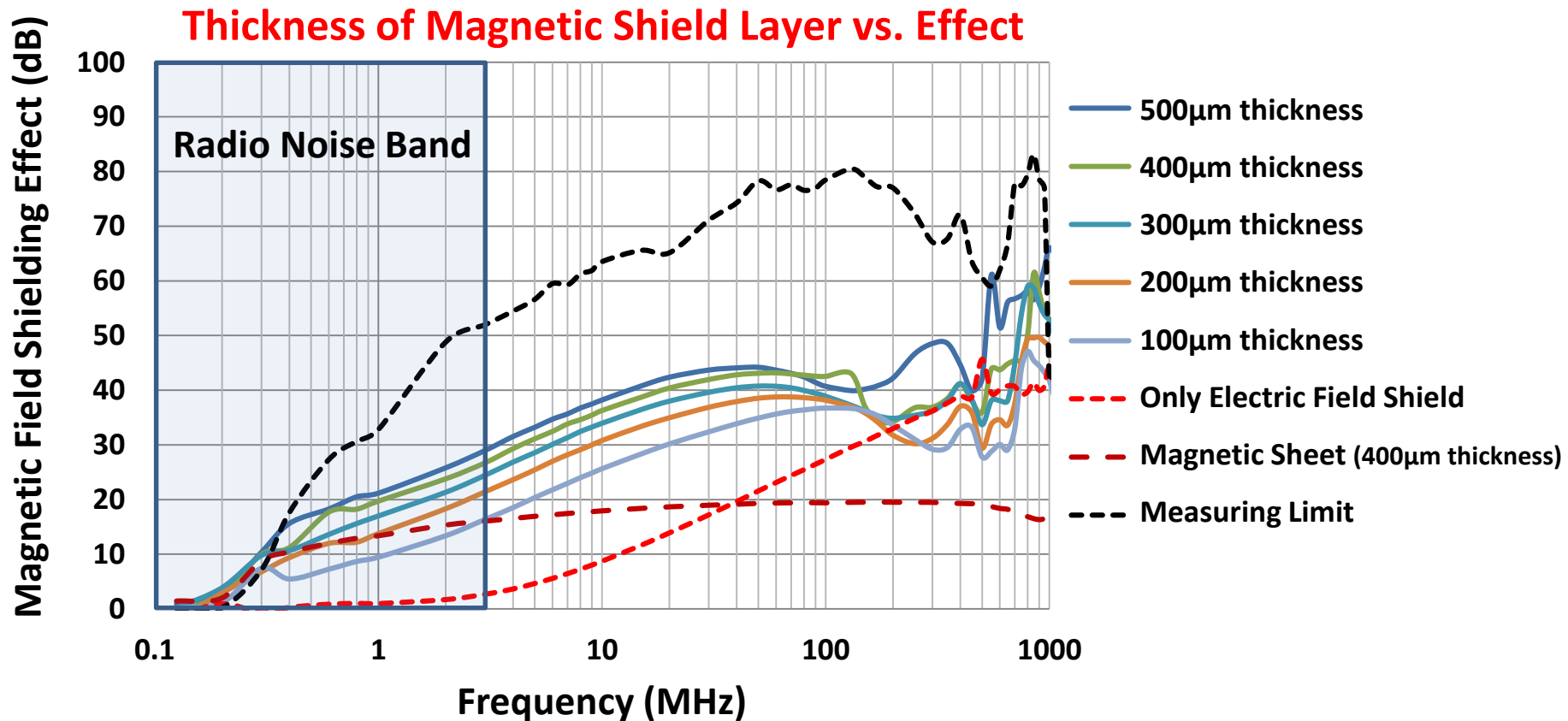
Magnetic Field Shielding (KEC Method)



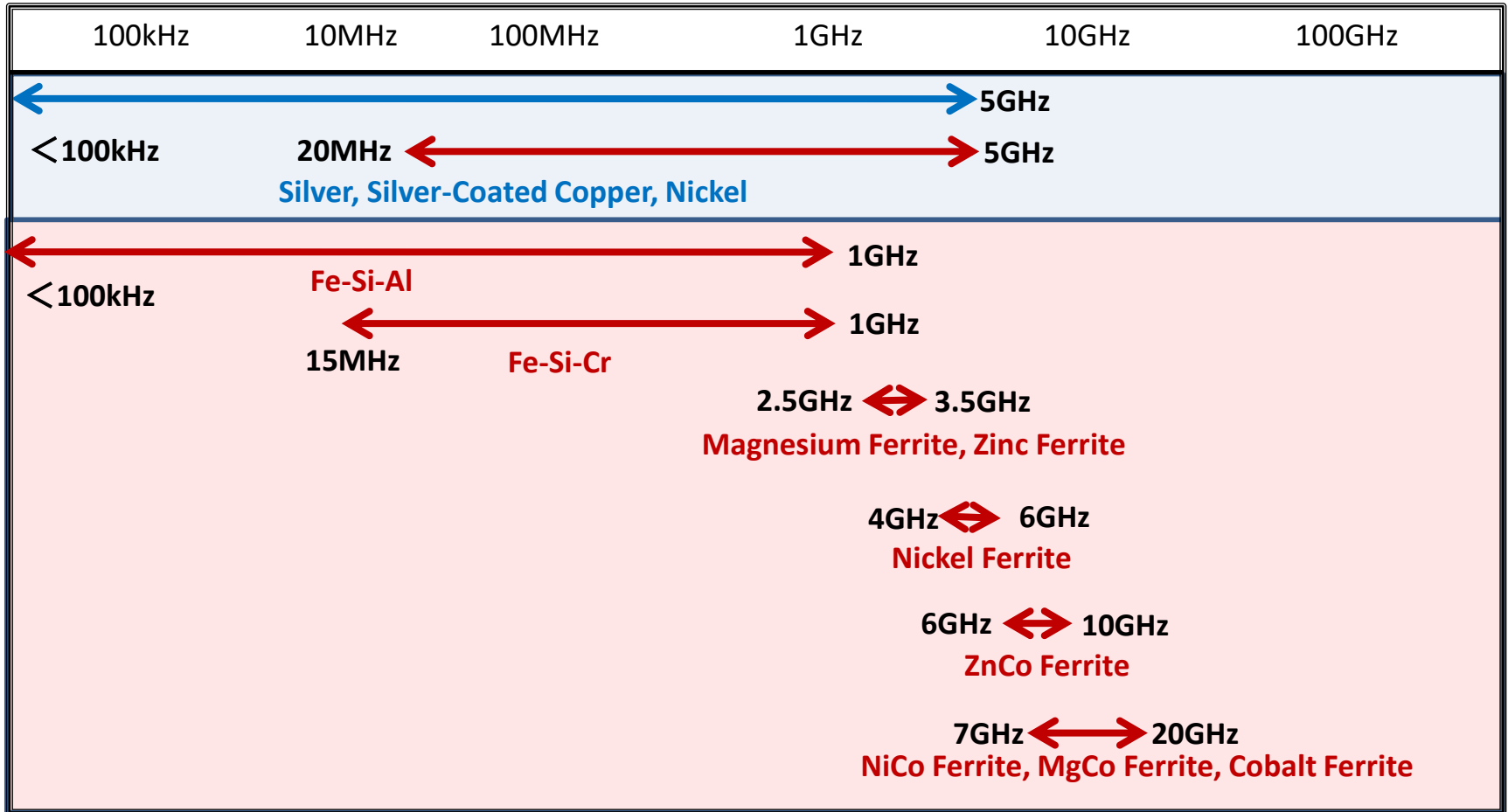
Magnetic Field Shielding (KEC Method)

Combination of Conductive and Magnetic Materials

➔ 10-20dB (70-90%) of magnetic shielding effect at 1MHz, radio noise band.



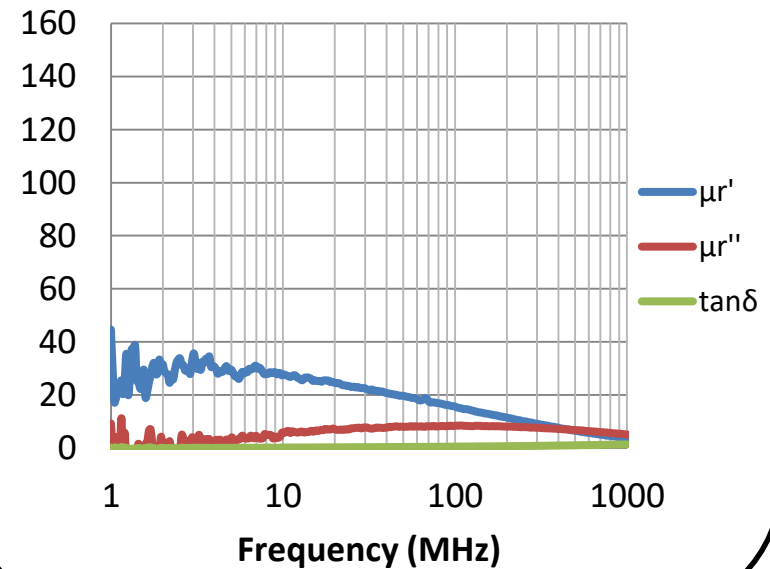
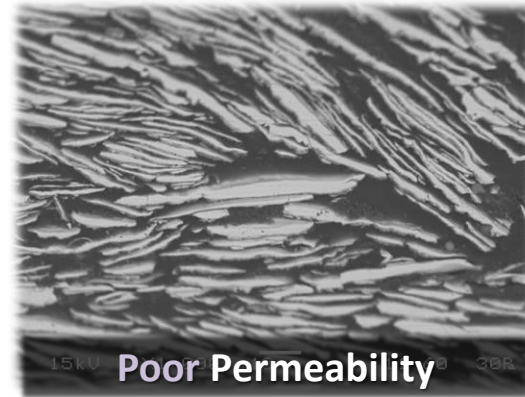
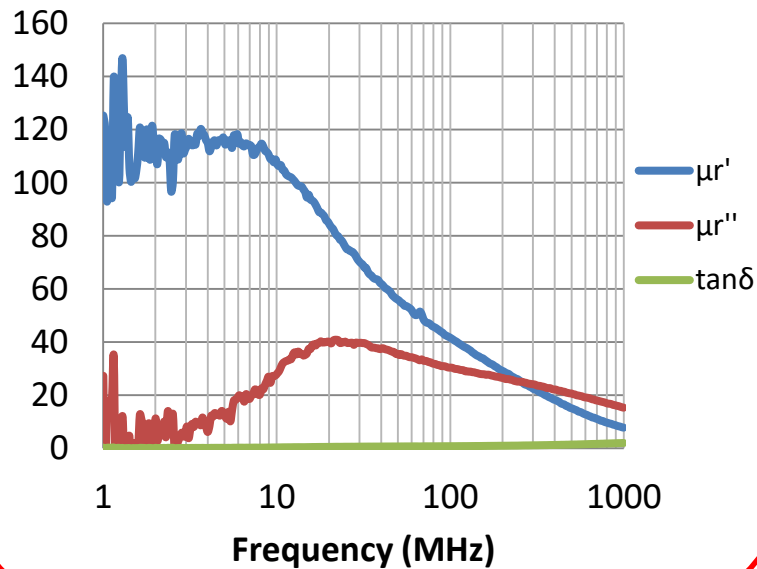
Comparison of Shield Materials



 Electrically Conductive Material
 Magnetic Material

 Electric Field (Shields by **Reflection**)
 Magnetic Field (Shields by **Absorption**)

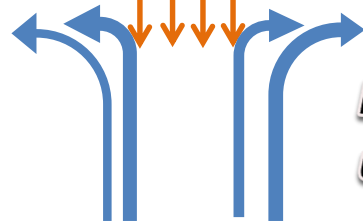
Cross Section & Performance



Application: Magnetic Shield Filter

Magnetic Field Noise Shielding (RFID Tag)

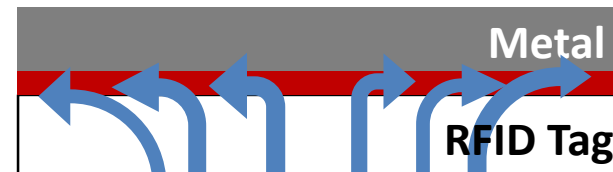
Metal Plate
+ RFID Tag



Repelled and unreadable...

With a metal back plate, reaction magnetic flux(↓) is generated by eddy currents. Magnetic flux from the reader/writer cannot go through the RFID antenna.

Metal Plate
+ **Magnetic Material (Filter)**
+ RFID Tag



Magnetic Material

Able to read properly

With a magnetic flux convergence, the magnetic flux can go through the antenna.

Application: Battery Case

Magnetic Field Noise Shielding (Battery Case)

Current
High tensile strength steel



Future
Plastic housing like CFRP

Requirement of
Weight reduction

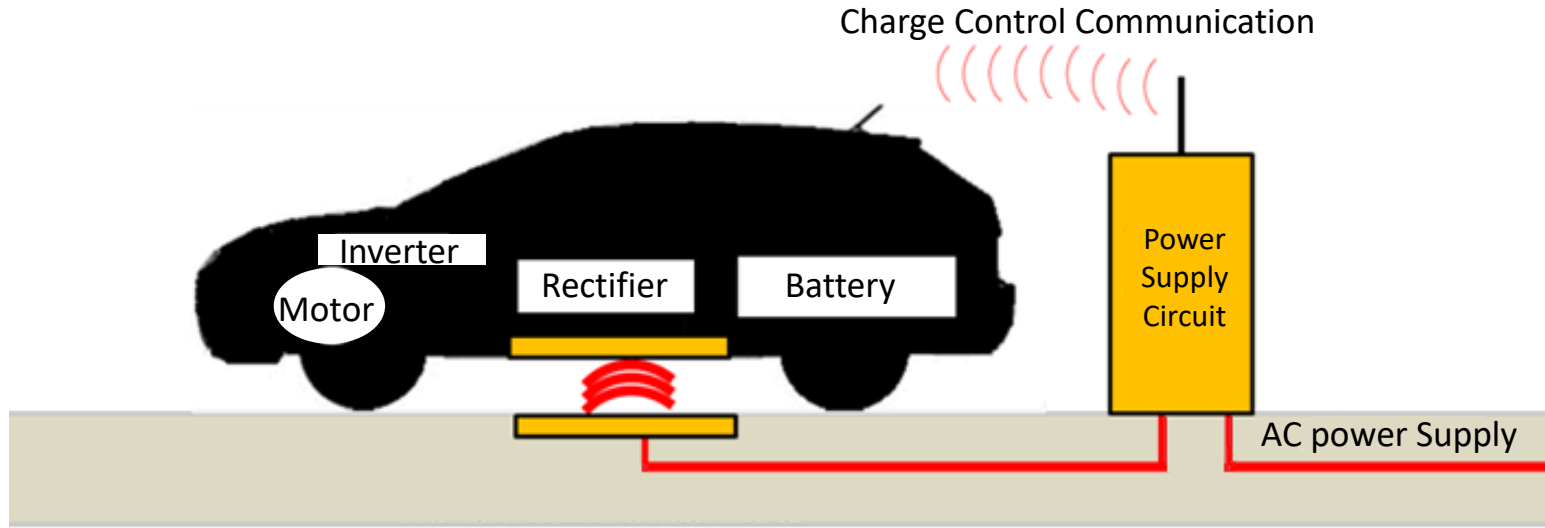
*Magnetic shield
is needed*



A car's inverter, inside of battery case, is a source of noise.

Application: Wireless Charging

Wireless Power Supply



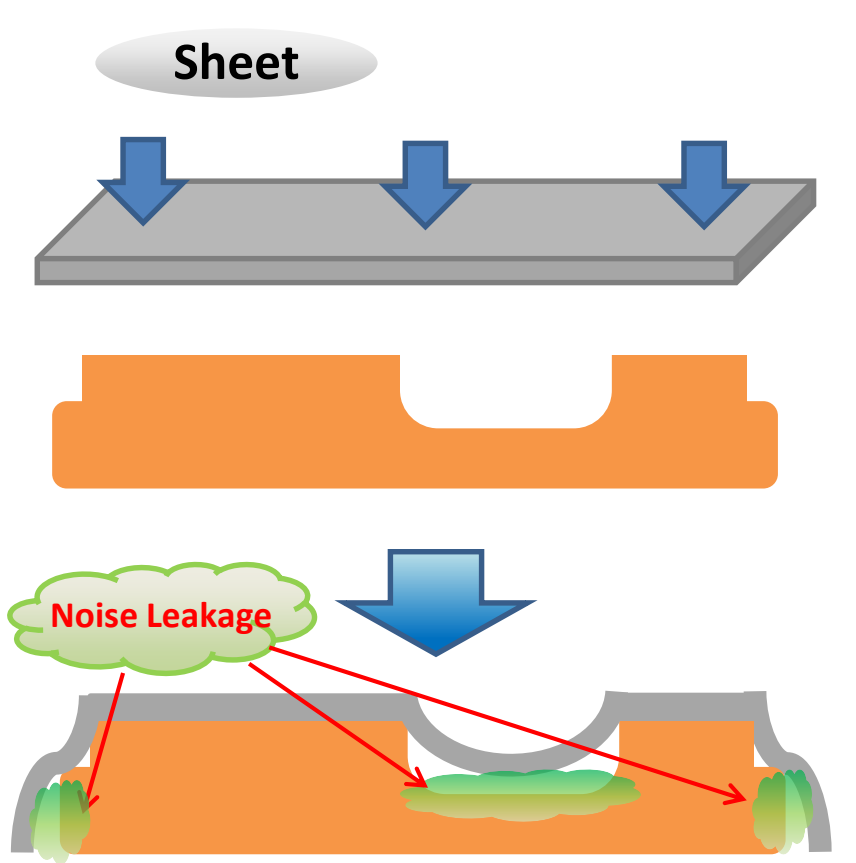
When a steel plate is on the back face of power-receiving coil on a vehicle's body, a part of magnetic flux generated by power-transmitting coil crosses that steel plate, then, eddy current is generated.

➔ **Power transmission loss**

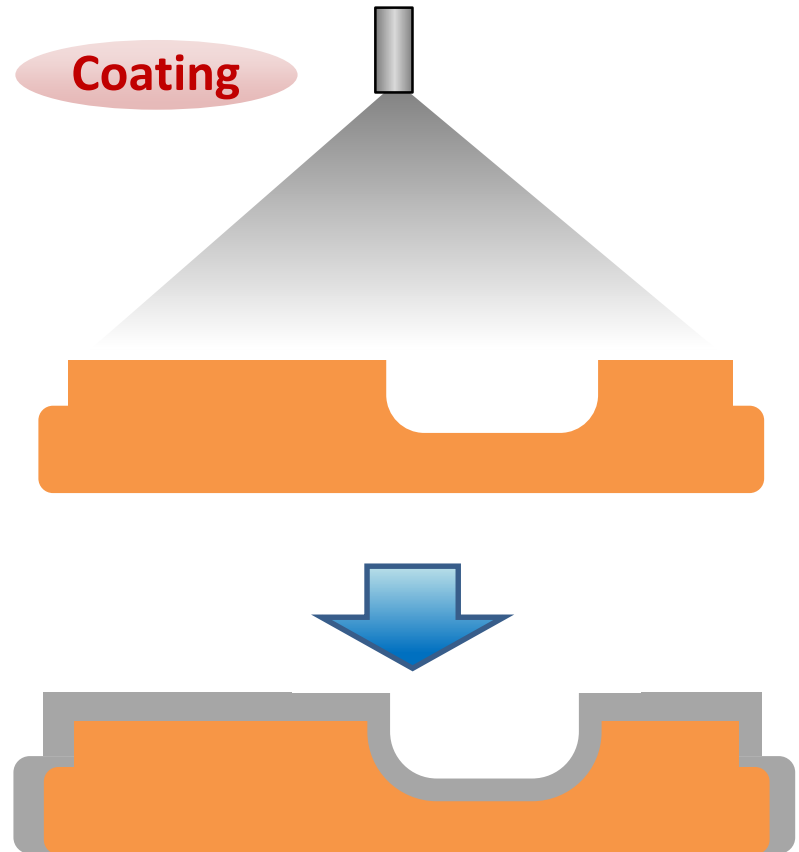
- Attaching **Ferrite core** is one of the solution but...
- Cost is **Expensive**
 - Weight is **Heavy**
 - **Not suitable** on complex shape of vehicle's body

➔ Applying **magnetic shield coating** can solve this problem.

Shield Paint Application



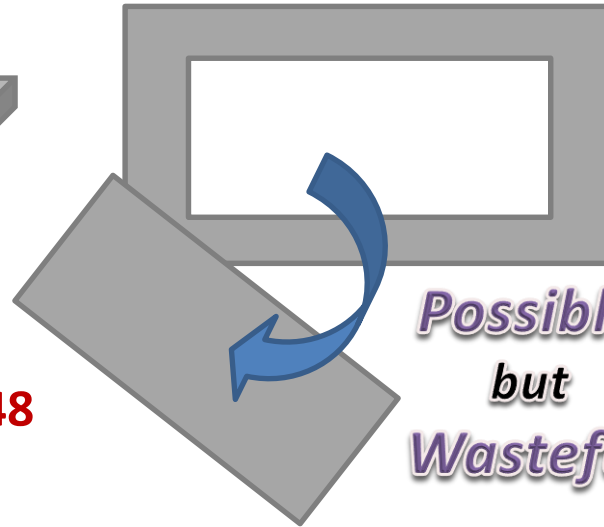
Magnetic field noise is leaked from the gap between housing and magnetic sheet.



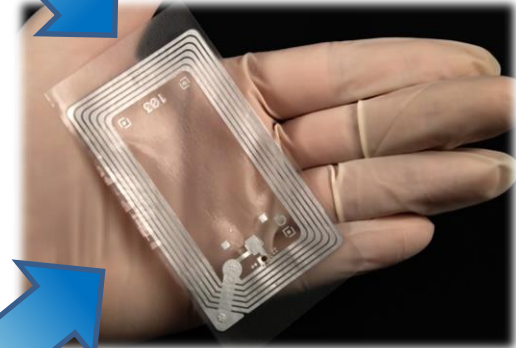
Can be applied **without gaps**.
Noise is shut out efficiently and does not leak.

Printable Shield and Printed Sheets

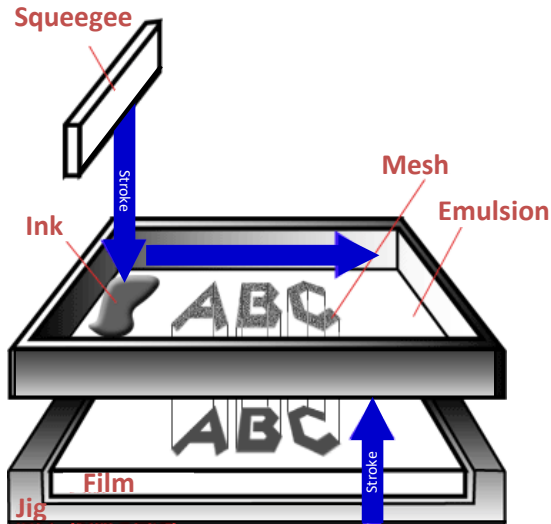
Conventional Sheet



*Possible
but
Wasteful*



Magnetic Shield Ink – XO-9048

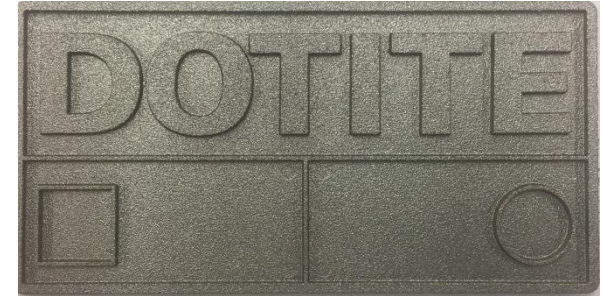


*Effective
and
Ideal*

Magnetic Shield Variations

Magnetic Shield Paint and Ink

XO-9021, XO-9048

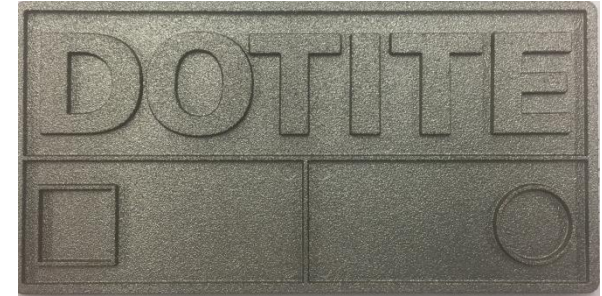


- Magnetic shield coating effective against radio noise (300kHz ~ 3MHz).
- The first magnetic shield coating with initial permeability of 100.
- Utilizes a special soft magnetic, flake-shaped powder in high concentration which is aligned in resin binder to form a shield against magnetic fields.
- Single component - XO-9021 dries at room temperature, making it easy-to-use.
- Useful for converting metal housings to resin to reduce weight.
- Can be used on large, complex surfaces or small, precise details.
- Allows for the optimization of shield film thickness for use with thinner tags
- **Can be supplied as a magnetic shield sheet**

Continuing Developments

Magnetic Shield for UHF Band

XO-9053



- Filtering paint for UHF band RFID transmission
- With magnetic properties where $\mu r' > \mu r''$ in the UHF band (860MHz ~ 960 MHz), contributes to improvement in readability of RFID tags by blocking the influence of moisture or metal around the tag
- Utilizes a special soft magnetic, flake-shaped powder in high concentration aligned by special techniques - a high RFID transmission can be realized
- Single component, room temperature drying type - so magnetic films can be easily formed
- Allows for the optimization of shield film thickness for use with thinner tags
- **Can be supplied as a magnetic shield sheet**

Continuing Developments

EMI Shield for Millimeter Wave

- Wave absorbing paint effective in the millimeter wave range (30GHz~300GHz).
- Absorption of 20dB (90%) realized as a thin film (150μm thickness).
- Effectively absorbs waves through dielectric absorption process provided by the special carbon filler in combination with the dielectric constant of the resin binder.
- Carbon type, two component, room temperature-drying paint.
- Ideal for use as a solution for millimeter wave radar casing (cavity) resonance.
- Provides flexible solutions, from coating large or complex surfaces to the mending of small, precise details.

XC-9082



Thank you for listening!

Where to find us:

- **Web site** ➡ <http://www.fkkasei.co.jp/>
- **E-mail** ➡ d-dewey@fkkasei.co.jp