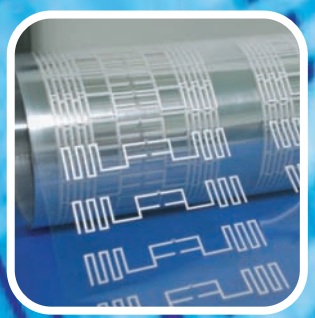
Nano Technology Products

Nano-Pia







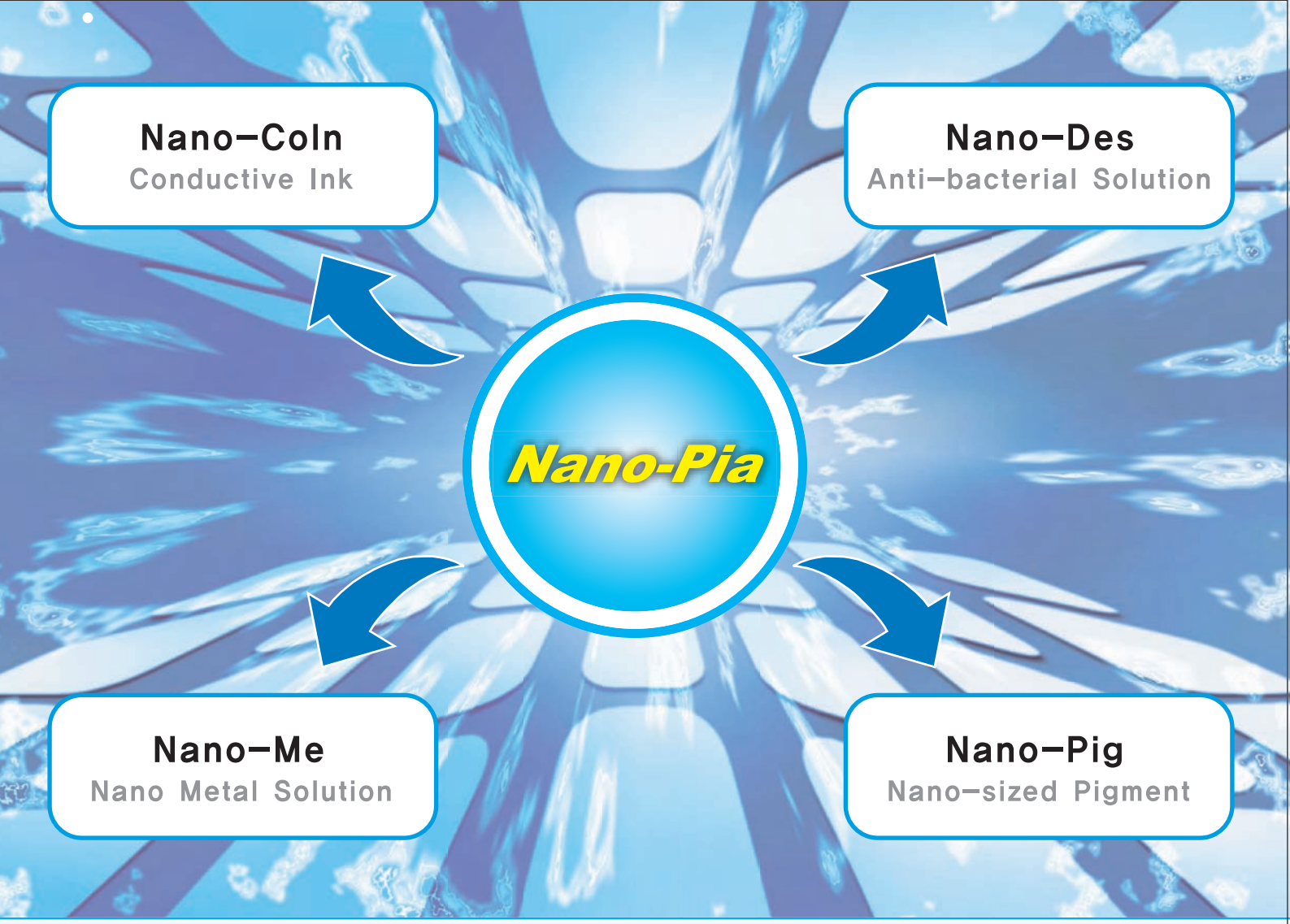

npk

Total Solutions For Nano Technology

NPK Co.,Ltd. (former Nippi Korea Co., Ltd.) was established in 1987 as a joint venture with Nippon pigment in Japan.
Our major products are the plastic compounds and the master batches. From these products, we have developed the dispersion technology of pigments. Now, on this dispertion technology foundation, we develop nano technology with nano chemistry.
Our nano products, named Nano-Pia, include the anti-bacteral solution, the conductive ink, the nano metal particle solution, and the nano- sized pigment.

■ Kumi Factory

■ Pyeongtack Factory



Brief History

1987.	3	Established Nippi Korea Co., Ltd.
1987.	7	Opened factory at Kumi.
1998.	12	Obtained ISO 9001 Quality System.
2000.	2	Name changed to NPK Co., Ltd.
2000.	10	Registered with KOSDAQ.
2001.	12	Takeover Yoochang Tech, an injection molding company.
2002.	11	Obtained ISO 9001;2000 Quality System.
2005.	3	Takeover Kostec, a master batch company.
2007.	7	Opened factory at Pyeongtack.

Nano-Coln

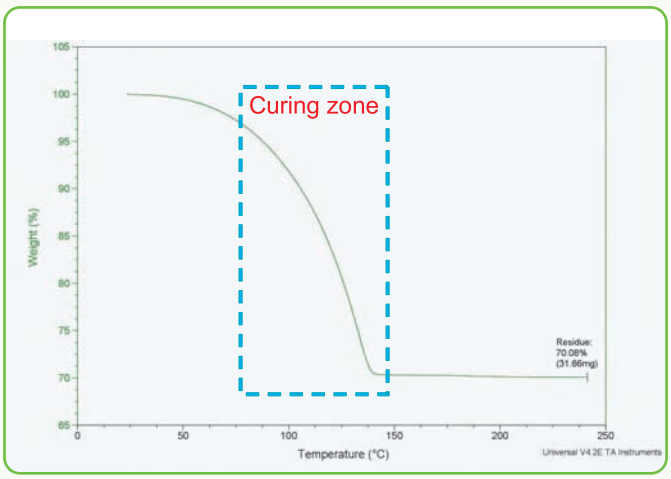
"Nano-Coln" **is the brand name of conductive ink.**

■ Nano-Coln Characteristics

- **High Silver Concentration : 40~90 wt%**
- **Low Curing Temperature : less than 110℃, printable on PET film**
- **Excellent Electronic Property : specific resistance ⟨ $5x10^{-6}$ Ω cm**
- **Variety of Printing Method : screen to gravure printing**

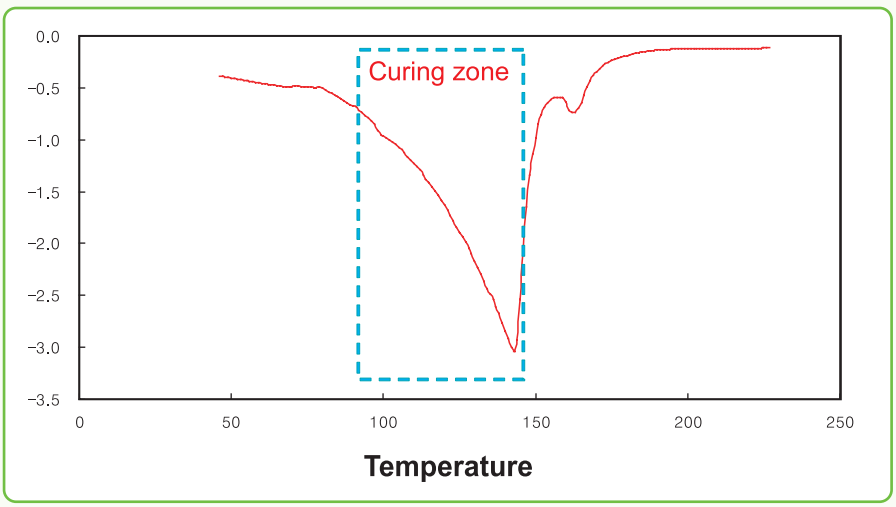
■ TGA Result

- **Silver Concentration ≒ 70 wt%**
- **Curing Temperature : 100~140℃**



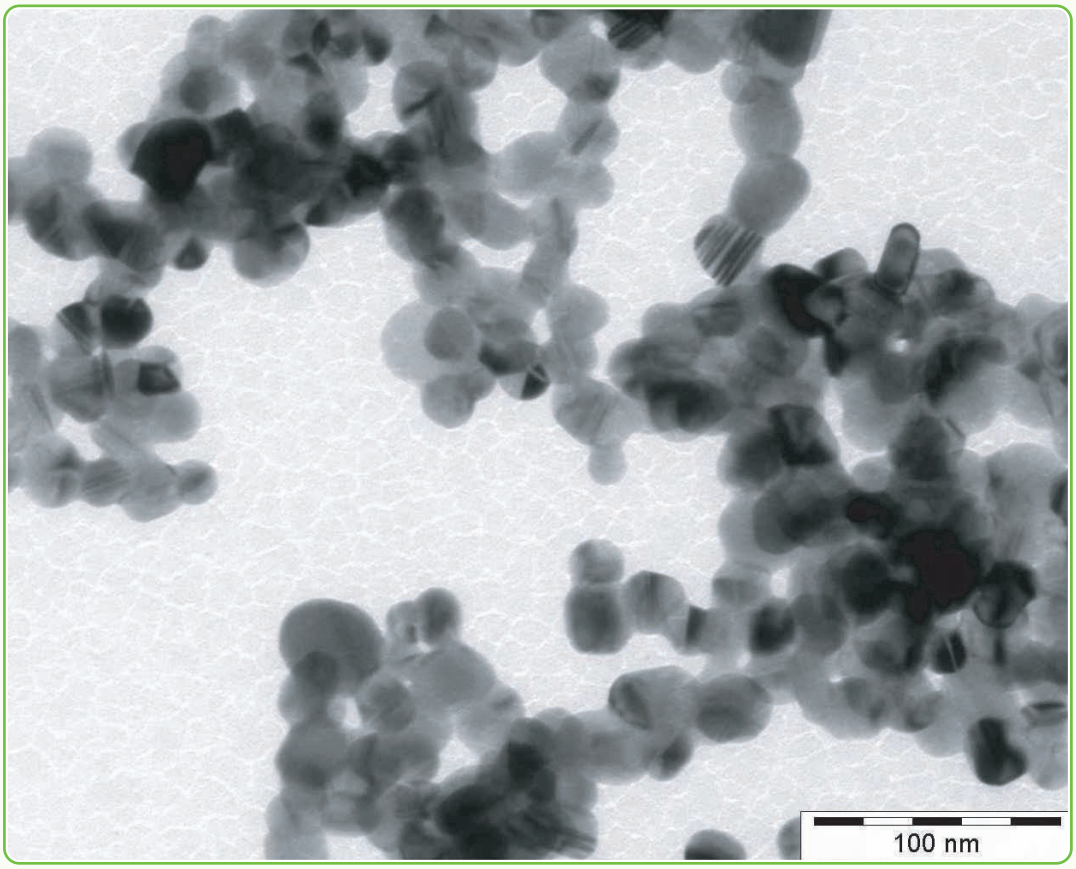
■ DSC Result

- **Curing Temperature : 100~140℃**



■ TEM Image

• Primary Particle Size : 20~50nm



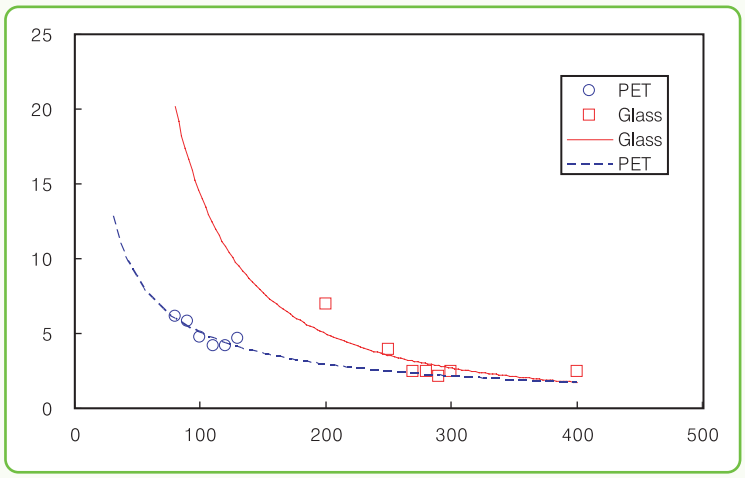
■ Electronic Properties

Property	Unit	Result
Curing Thickness	㎛	1.3
Surface Resistance	Ω	$3.1x10^{-2}$
Specific Resistance	Ω ㎝	$3.9x10^{-6}$

Nano-CoIn

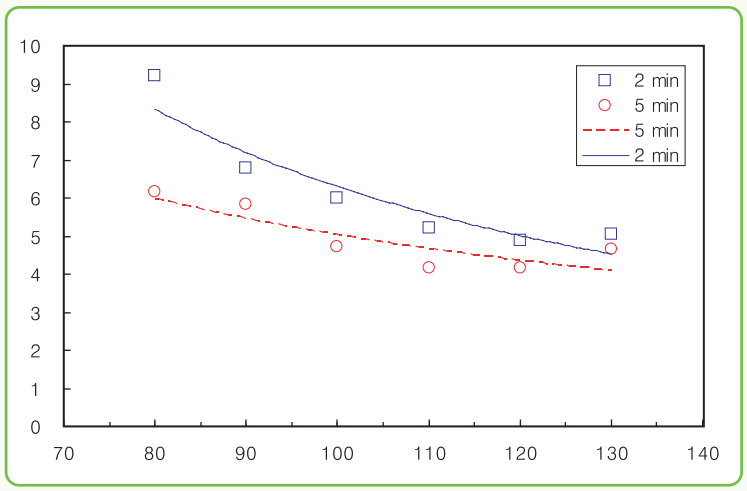
■ Specific Resistance

• Depending on curing temperature and time, 2.5~5 x10^{-6} Ω cm



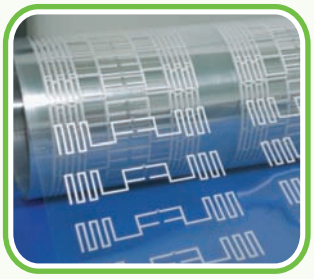
Effect of curing temperature

Effect of curing time



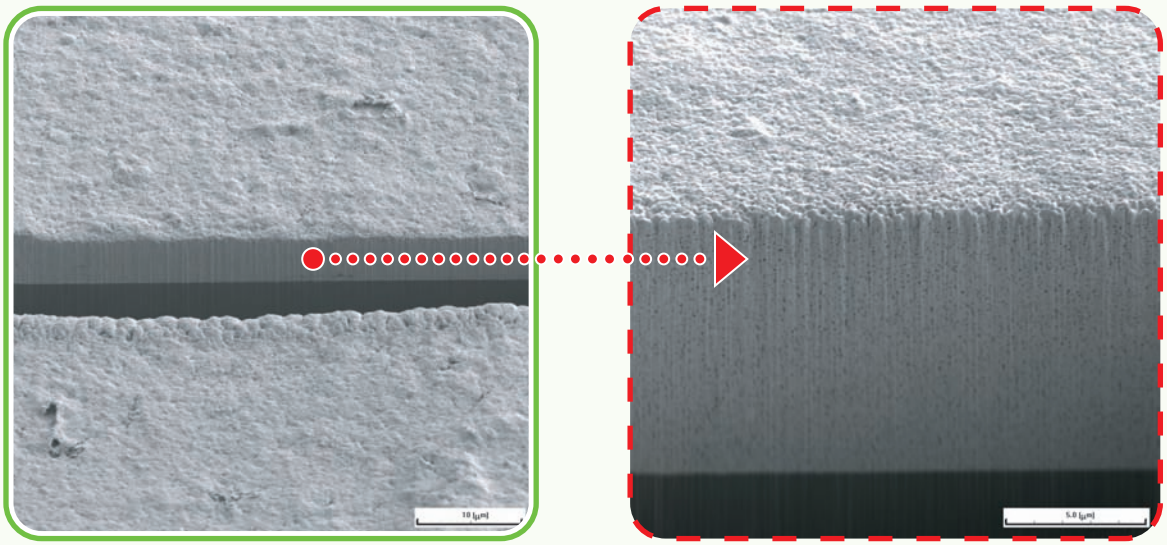
■ Printed Examples

• By screen printing



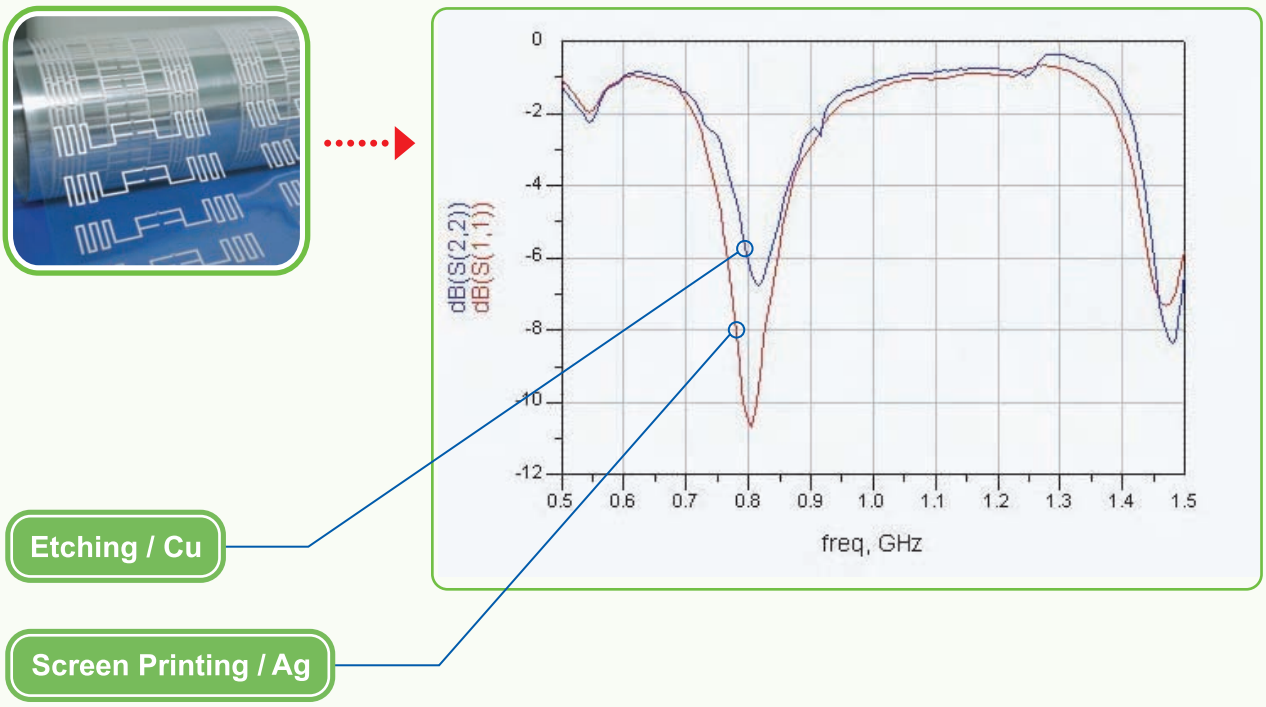
■ SEM Images

- It is easy to find low temperature sintering.



■ RFID Application Example

- Similar antenna performance



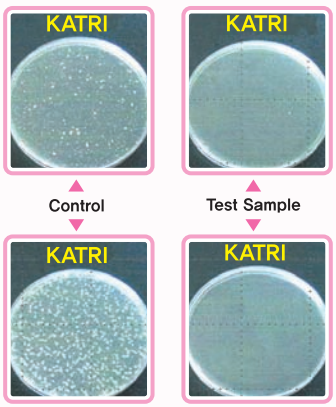
Nano-Des

"Nano-Des" **is the brand name of anti-bacterial 'Colloidal Nano Silver' & it's 'Polymer Master Batch'.**

■ Nano-Des Characteristics

Colloidal Nano Silver	Polymer Master Batch
Anti-bacterial solution	Anti-bacterial master batch
2~15nm size	Variety of polymer applications
Non-harmful	High dispersion Technology
High dispersion Technology	Efficient at low concentration

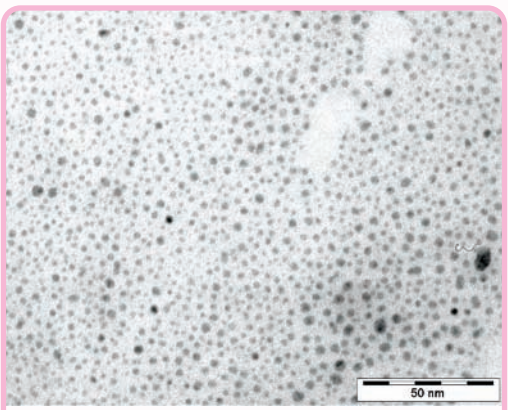
■ Anti-bacterial Activity & Particle size



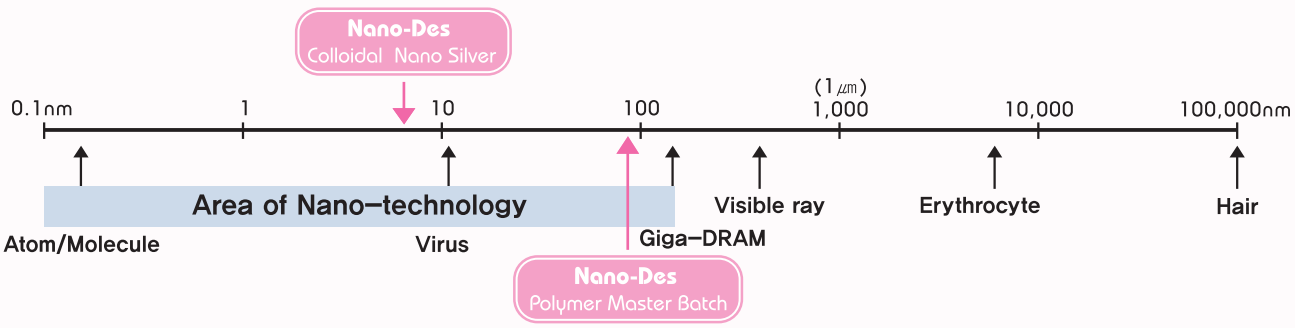
Test1-Staphylococcus aureus
ATCC6538P, Test result-99.9%.

Test2-Escherichia coil
ATCC25922, Test result-99.9%.

Anti-bacterial Activity



Nano-sized Particles (TEM)



■ Anti-bacterial Test

• Colloidal Nano Silver

Solvent	Silver Concentration (ppm)	Bacteriostatic Reduction Rate(%)		Test Method	Remark
		Staphylo coccus aureus	Escherichia coli		
Water	100~100,000	99.9	99.9	KS M 0146-2003	Particle size 2~15nm
Bu-OH	100~100,000	99.9	99.9		
PEG	100~100,000	99.9	99.9		

• Polymer Master Batch

Resin	Silver Concentration (ppm)	Bacteriostatic Reduction Rate(%)		Loading ratio	Test Method
		Staphylococcus aureus	Escherichia coli		
PP	1,000~2,000	99.9	99.9	5~10 (%)	JIS Z 2801-2000
PE	1,000~2,000	99.9	99.9		
ABS	1,000~2,000	99.9	99.8		
PET	1,000~2,000	98.7	98.6		
PA6	500~1,000	99.9	99.9		
PVC	1,500~3,000	99.9	99.9		

The type of solvent, resin, and silver concentration can be adjusted upon requests from customers.

■ Toxicity Test


TEST REPORT

TEST RESULTS

DIRECTOR GENERAL, KOREA TESTING & RESEARCH INSTITUTE

Skin


TEST REPORT

TEST RESULTS

DIRECTOR GENERAL, KOREA TESTING & RESEARCH INSTITUTE

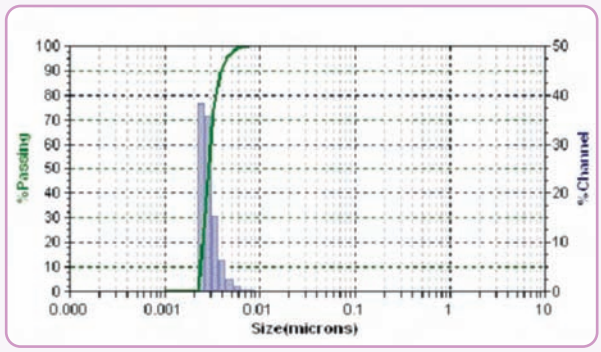
Oral

Nano-Me

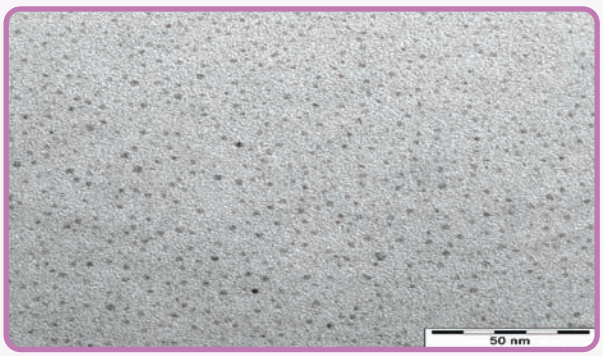
"Nano-Me" **is the brand name of nano-sized metal solution. Nano-Me includes the nano-sized metal of Silver, Copper, Iron, Tin, Nickel, Zinc, and Cobalt.**

■ Nano Copper

Particle Size Distribution



Nano-sized Particles (TEM)



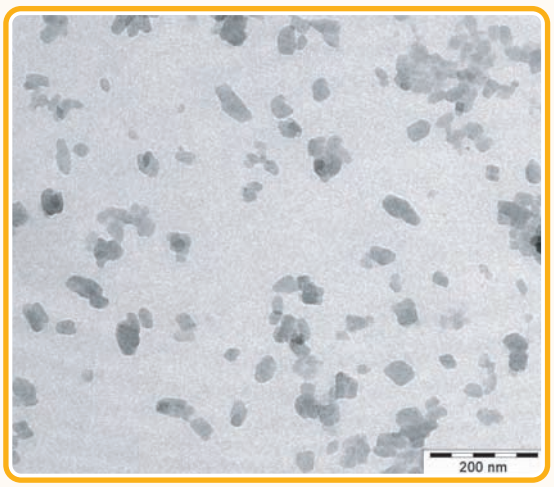
■ Nano-Me Characteristics

Nano Metal	Particle Size	Concentration	Color	Solvent	pH
Silver	2~10nm	〈 12wt%	Red	PEG, EG, Water	4±0.5
Copper	1~7nm	〈 12wt%	Green	PEG	4±0.5
Iron	2~20nm	〈 10wt%	Red	Water	2±0.5
Tin	2~10nm	〈 3wt%	Yellow	DMF	5.5±0.5
Nickel	2~10nm	〈 10wt%	Sky-Blue	PEG	4±0.5
Zinc	2~20nm	〈 12wt%	Yellow	PEG	3±0.5
Cobalt	2~30nm	〈 10wt%	Red	PEG	3±0.5

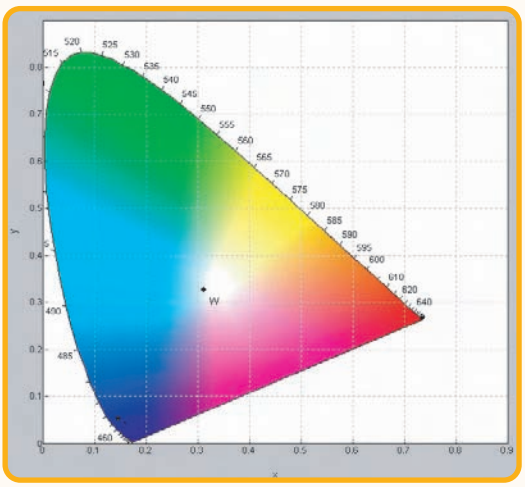
Nano-Pig

"Nano-Pig" **is the brand name of nano-sized pigment. We have equipments for the mill base for color filter in LCD and for plastic applications. Nano-Pig could improve color strength and long term stability, provide better transparence, and reduce the amount of pigment loading.**

■ Mill Base for Color Filter in LCD

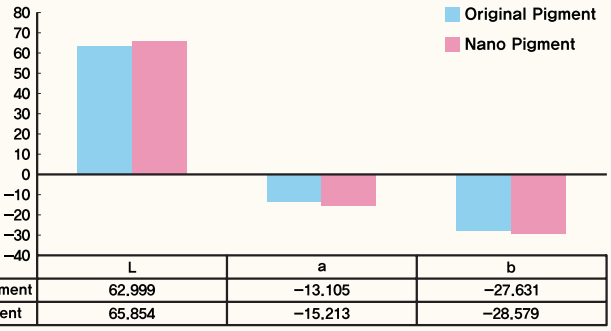


TEM Picture



Color Coordinate

■ For Plastic Application



	L	a	b
Original Pigment	62.999	−13.105	−27.631
NanoPigment	65.854	−15.213	−28.579

Nano Pigment has brighter and more bluish color