

# 水性木器塗料的發展與技術動向

(Technology Trends and Development of Waterborne Wood Coatings)

黃 義 欽

德一塗料股份有限公司 總工程師 / 顧問

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# 綱 要

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## 1. 水性木器塗料的發展背景

(Background of Developing Waterborne Wood Coatings)

## 2. 水性木器塗料的成膜機構與性能

(Film Formation and Performance of Waterborne Wood Coatings)

## 3. 水性木器塗料未來發展的趨勢

(Technology Trends of Waterborne Wood Coatings)

# 水性木器塗料的發展背景

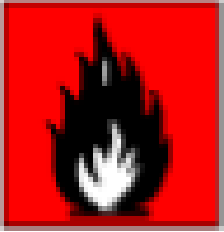
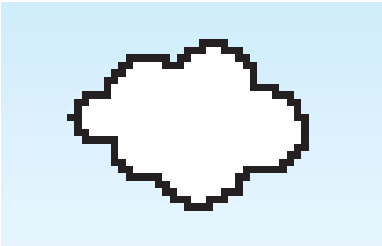
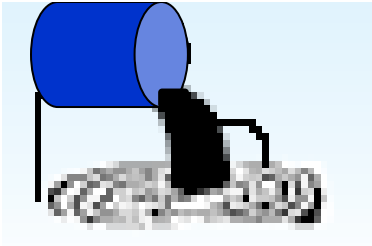
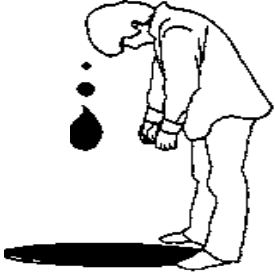
(Background of Developing Waterborne Wood Coatings)



# 水性木器塗料的發展背景

(Background of Developing Waterborne Wood Coatings)

油性  
(Solvent Based)

安全(Safety)	環境(Environment)		健康(Health)
			
Flammable Liquid	Air Pollution	Water Pollution	Health Effect

水性  
(Water Based)

# 水性木器塗料的發展背景

(Background of Developing Waterborne Wood Coatings)

## Typical VOC Contents of Wood Coatings

Coating Type	VOC content (g/Liter)
<b>Nitro-Cellulose series (NC)</b>	<b>550 – 700</b>
<b>Acid Curing series (AC)</b>	<b>500 – 650</b>
<b>Polyurethane series (PU)</b>	<b>400 – 500</b>
<b>Unsaturated Polyester series (UP)</b>	<b>100 – 200</b>
<b>UV Curable Acrylate series (UV)</b>	<b>0 – 100</b>
<b>Waterborne series (WB)</b>	<b>0 – 100</b>

# 水性木器塗料的發展背景

(Background of Developing Waterborne Wood Coatings)

## 綠建材規範

(Criteria of Green Building Materials)

### Limitation of air pollution by solvents

- Low VOC content – not to exceed 100 g/l
- Free of Aromatic Hydrocarbon
- Free of Halogenated solvents

### Limitation of the use of hazardous substances for the environment and health

- Free of Formaldehyde
- Free of Heavy Metals (Pb, Cd, Cr(VI), As, Hg, Ba, Se, Sb)
- Free of Phthalate Plasticizers (DBP, DEHP, BBP, DINP, DIDP, DNOP)
- Free of Alkyl Phenol Ethoxylates (APEO)

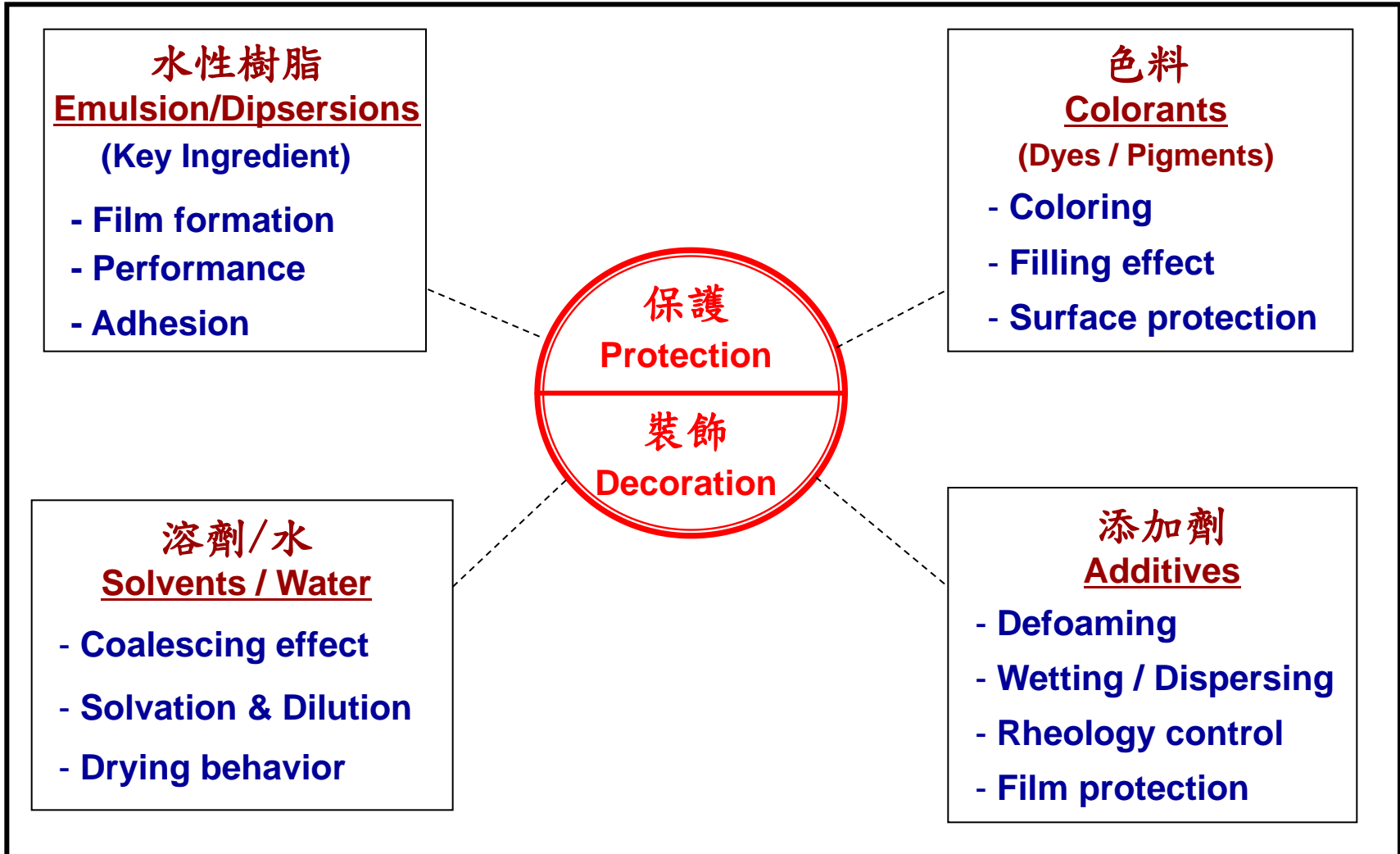
# 水性木器塗料的成膜機構與塗膜性能

(Film Formation and Performance of Waterborne Wood Coatings)



# 水性木器塗料組成

(Waterborne Wood Coating Formulations)





# 水性樹脂

(Waterborne Emulsion / Dispersion)

## Emulsion

Polymer

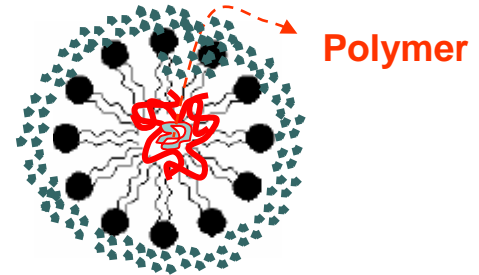
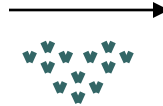


+

Emulsifier



Water



Micelle

External stabilization

## Dispersion

(1) Anionomer

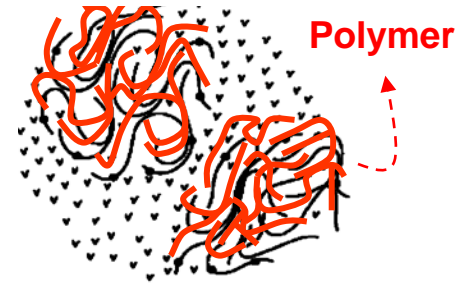


or

(2) Cationomer



Water



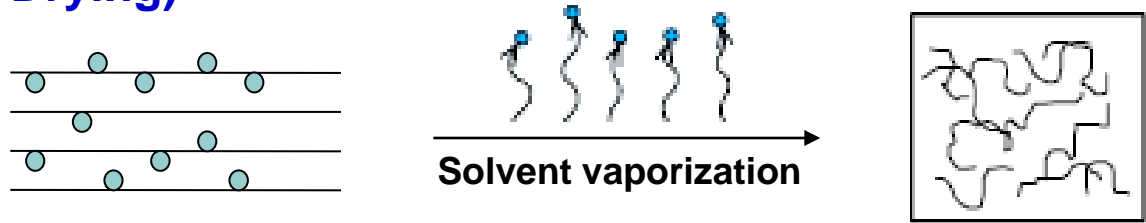
Internal stabilization

# 塗料成膜機構

## (Film Formation Mechanism)

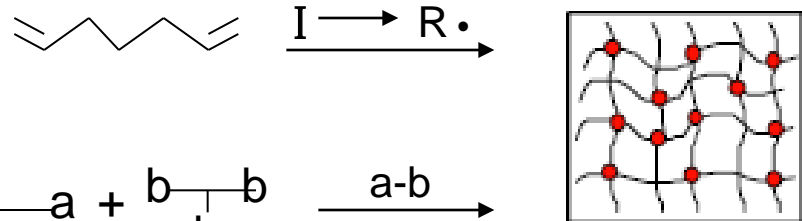
### 1 物理乾燥(Physical Drying)

(Air Drying)

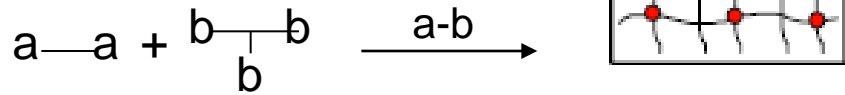


### 2 化學反應硬化(Chemical Reaction Curing)

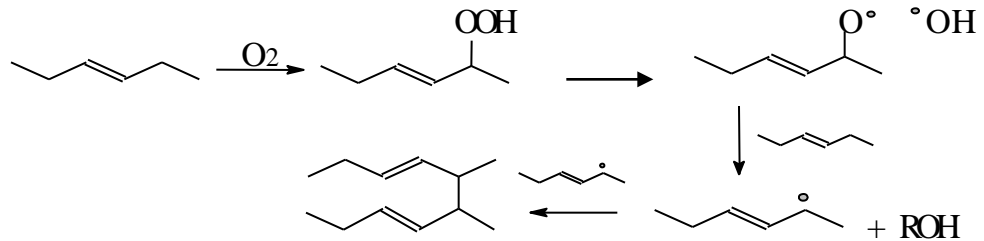
#### 2.1 Radical Chain Polymerization



#### 2.2 Step Growth Polymerization



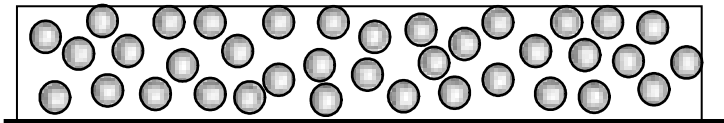
#### 2.3 Oxidative Drying



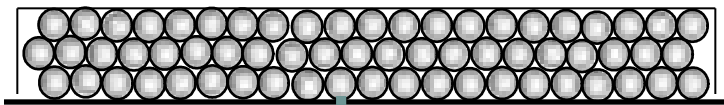
# 塗料成膜機構

(Film Formation Mechanism)

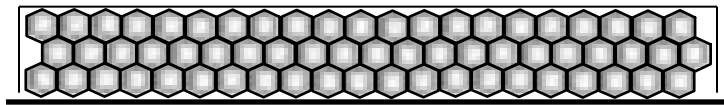
## Physical Drying



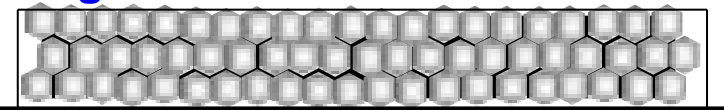
Stage I Evaporation of water



Stage II Particle deformation



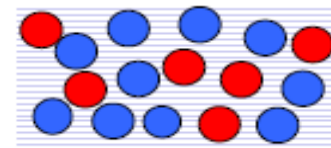
Stage III Coalescence



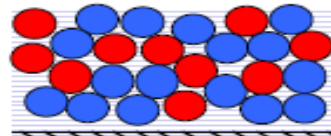
Stage IV Interdiffusion of polymer chains



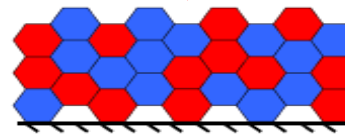
## Chemical Reaction Curing



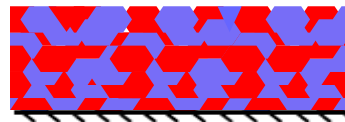
- Mix
- Dispersion



- Water evaporation
- Starting reaction



- Close packing & deformation
- Crosslinking reaction



- Particles coalescence
- Crosslinking reaction



- Homogeneous film
- Crosslinked network

# 塗料配方設計與應用

## (Coating Formulation Guide)

應用領域

Application Fields

塗膜性能

Film Properties

(Customer requirement)

塗裝程序

Coating Schedule

硬化技術

Curing Technology

塗裝方法

Application Methods

塗料配方

Formulation

# 塗料配方設計與應用

## (Coating Formulation Guide)

### Application Fields

- Interior      - Exterior

(Solid wood / Veneer laminated / Plywood)

### Film Properties

(Customer requirement)

- |                         |                           |
|-------------------------|---------------------------|
| (a) Appearance          | (b) Mechanical properties |
| (c) Thermal properties  | (d) Interfacial adhesion  |
| (e) Chemical resistance | (f) Weatherability        |

### Coating Schedule

- (a) Surface preparation
- (b) Primer / Wash coat
- (c) Base coat
- (d) Pigmented coat / Stain
- (e) Top coat

### Curing Technology

(Film Formation Mechanism)

- (a) Physical drying
- (b) Chemical reaction curing

### Application Methods

- Spray
- Roller / Curtain
- Brush
- Dipping
- Electrostatic

### Formulation

Resins

Solvents

Pigment/Extender

Dyestuff

Additives

# 德一水性木器塗料

## (TE-1 Waterborne Wood Lacquer)

### WB Series Products

- |         |  |
|---------|--|
| (1) 底漆  | Sanding Sealer   |
| (2) 面漆  | Clear Top Coat [ <i>Matte</i> ,<10% ] , [ <i>Satin</i> ,25+10% ] , [ <i>Semi gloss</i> ,50+10% ] |
| (3) 著色劑 | Dye Stain [ <i>Transparency</i> ]  |
| (4) 色漆  | Pigmented Lacquer [ <i>Opaque</i> ]  |

### Characterization

1. VOC compliant and low in odor.
2. Quick drying, excellent leveling and surface feel.
3. It is designed for finishing wooden products.

### Application Tips

1. It can be reduced up to 5 % with pure water to achieve proper atomization.
2. Application methods : brush, spraying and roller coatings.
3. Application temperature : 20~35 °C. Relative humidity : < 75 %  
\* **High humidity and/or low temperatures will extend the drying interval.**

# 水性/油性木器塗料產品性能比較

(Performance Comparison of SB and WB Wood Lacquers)

Characteristics	SB NC Lacquer	WB Acrylic Lacquer
Volatile Organic Compounds, VOC (g/Liter)	500 ~ 600	< 100 (Aromatics free)
Solid Content (%)	35 $\pm$ 2	35 $\pm$ 2
Drying Time (wet film : 80 $\pm$ 10 g/M <sup>2</sup> ) @ 25°C x 75% R. H.	Dry to touch : 15 min. Dry hard : 30 min. Dry through : 4 hrs	Dry to touch : 20 min. Dry hard : 50 min. Dry through : 6 hrs
Finish Clarity	5	4
Pencil Hardness	F	F <sup>-</sup>
Moisture Resistance	3	3
Heat Resistance	2	3
Household Chemical Resistance	3	4
Yellowing in Time	1	4

Note : 5 = Excellent; 1 = Poor.

# 水性木器塗料未來發展的趨勢

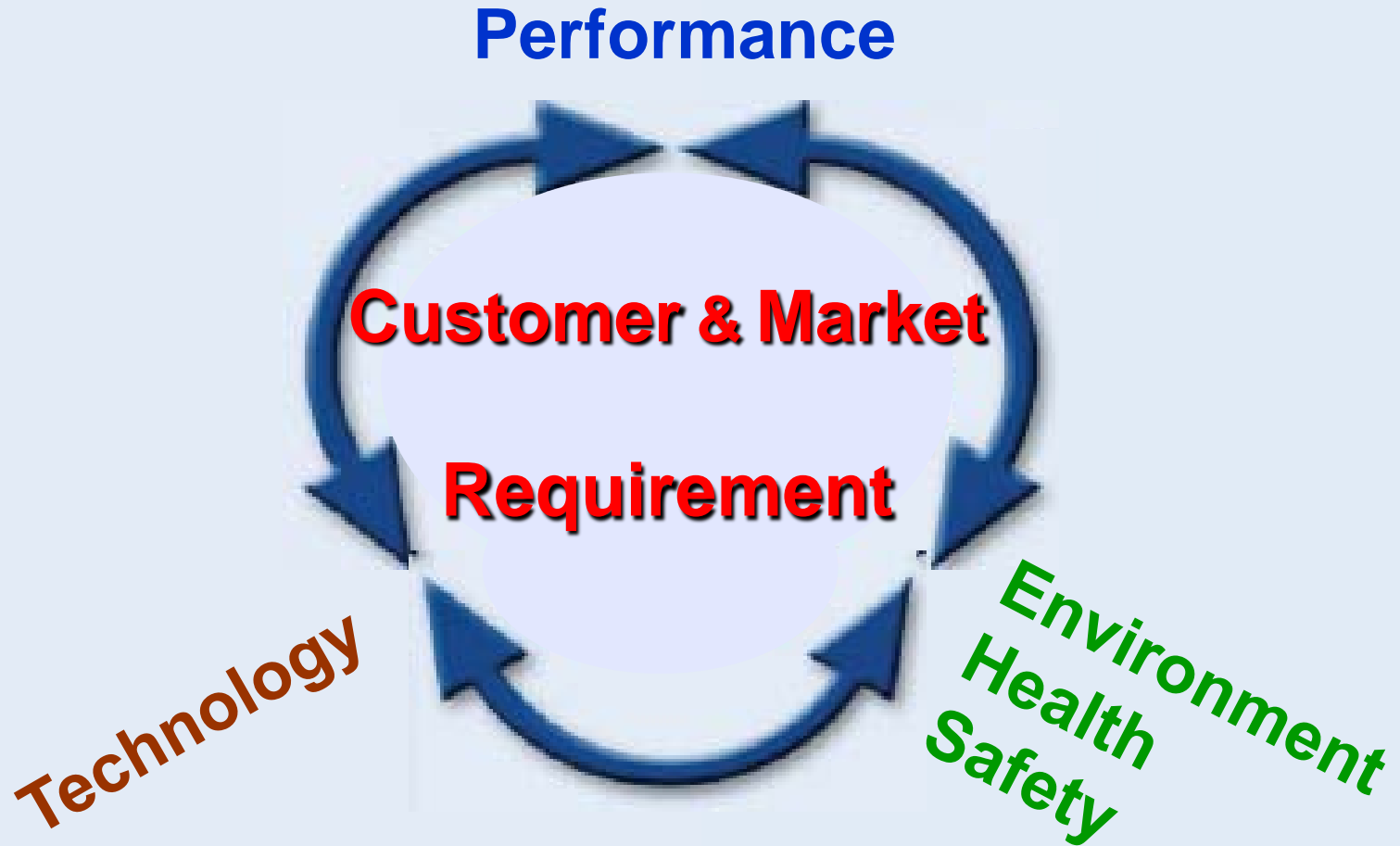
(Technology Trends of Waterborne Wood Coatings)





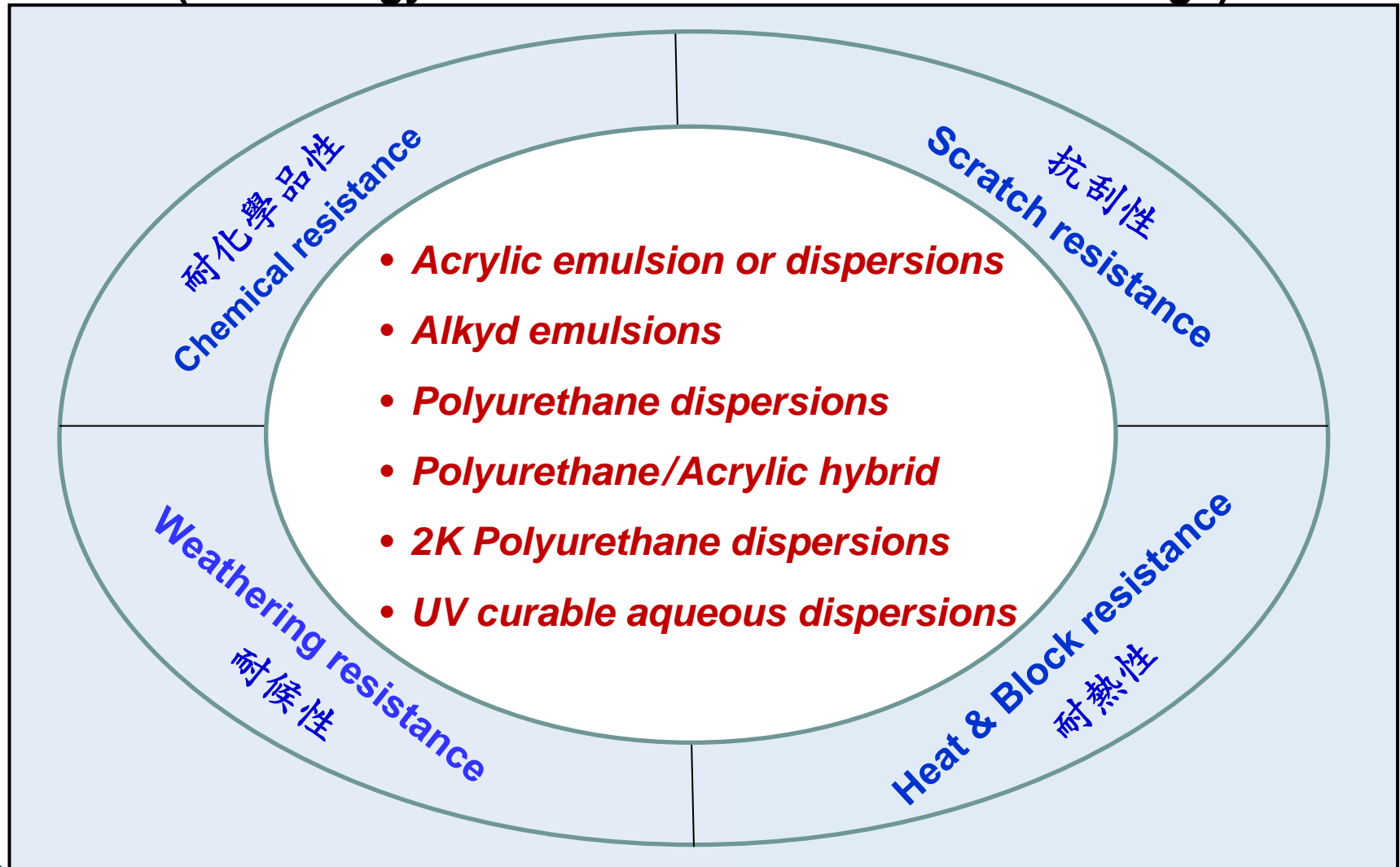
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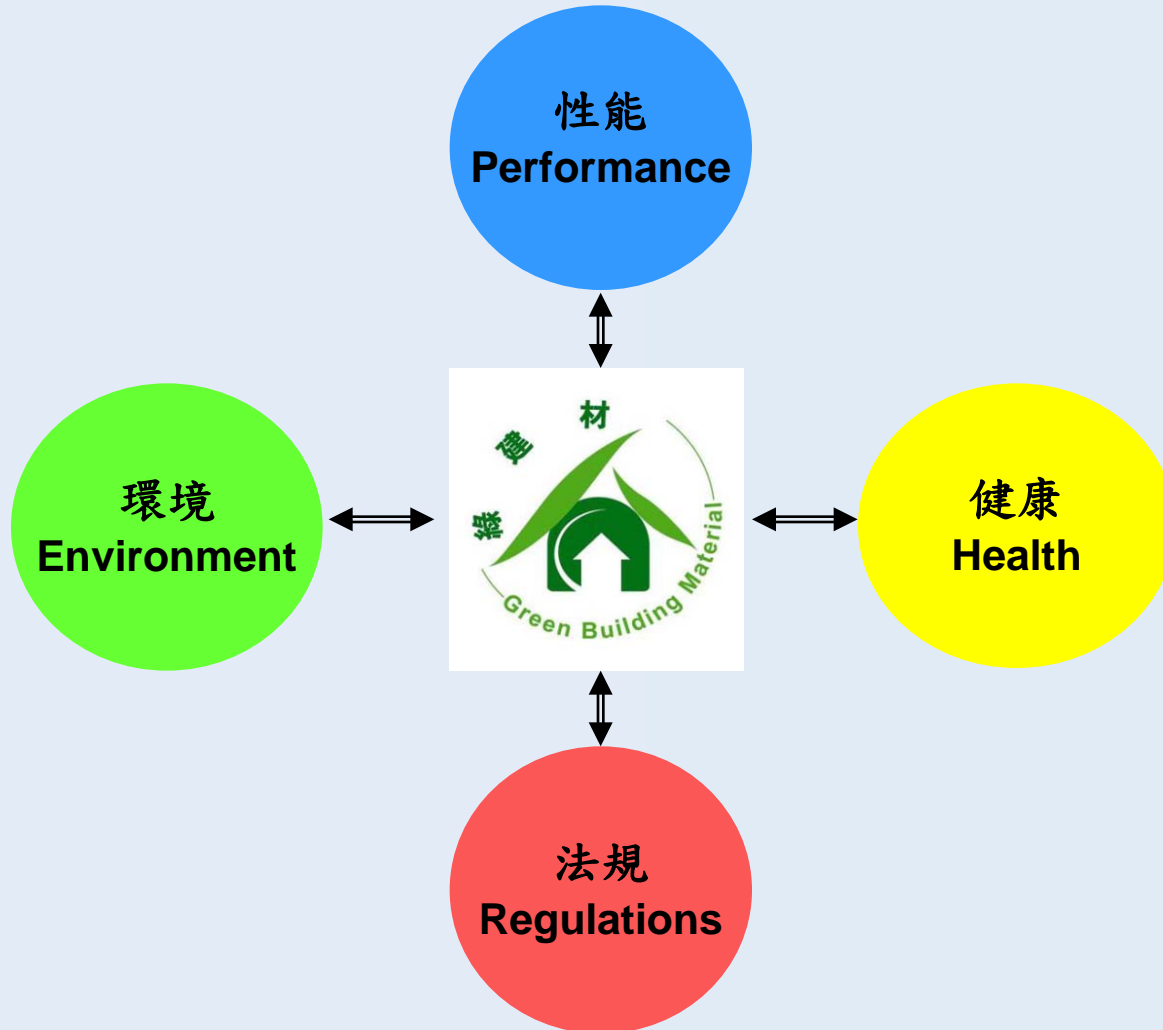
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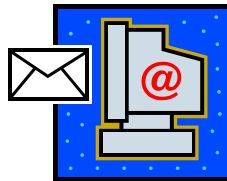
# The End

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*Thank You for Your Attention*



**04 - 25282195**



**[jy.tech@msa.hinet.net](mailto:jy.tech@msa.hinet.net)**