

Copper Sulfate Plating for Roll to Roll Processing

US-01 Process

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Due to various problems, early continuous electro-plating equipment designed for film materials could not be put into practical use. With such equipment, only one side could be plated, and a horizontal transfer process was adopted in order to make film transportation easier.

Rough plating, pits and other defects would often occur because soluble anodes (high-phosphorous copper) were used. Moreover, because the power supply system was submerged, the durability of the contact points was often poor.

In order to solve these problems, new equipment utilizing insoluble anodes (made from titanium-coated stainless steel) was developed. As a result, the occurrence of rough plating and other defects was improved, however such technology did not improve much on the generation of pits. Furthermore, new defects began to appear instead: the properties of plating film were lowered, the film was subject to more internal stress, and warpage defects and abnormal consumption of additives occurred.

Moreover, the existing horizontal transfer systems were not suited to double-sided film materials that came into use; each side of the plating film would have different properties, which made handling difficult. For this reason, vertical transfer plating equipment was developed.

However, it was found that due to the structure of the equipment, the additives added to plating solution and degreasing agents used for pretreatment in the horizontal transfer equipment could no longer be used, which necessitated development of new additives and pretreatment agents.

We thus developed the US-01 process, specifically designed for copper sulfate plating.

[Features]

- Deposited film has superior ductility and thermal shock-resistance.
- The internal stress can be kept lower than with conventional addition agents.
- The plating bath is highly stable and the plating solution can be easily controlled.
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[Bath composition and bath control method]

Component	Range	Standard
Copper sulfate $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (g/L)	100 - 150	125
Sulfuric acid H_2SO_4 (g/L)	100 - 150	125
Chlorine ion Cl^- (ppm)	40 - 80	60
US-MU (mL/L)	1 - 4	2
US-01 (mL/L)	For filling	For filling

[Operating conditions]

Item	Range	Standard
Cathode current density (A/dm ²)	1 - 6	3
Anode current density (A/dm ²)	1 - 2 (when using high-phosphorous copper)	1.5
Transfer speed (m/min)	0.5 - 2	1
Bath temperature (°C)	20 - 30	25
Agitation	Combination of air agitation and jet agitation	
Filtering	Continuous filtering	
*1 Anode	High-phosphorous copper (0.03 to 0.08% phosphorus) or insoluble anode	

* 1 . If a high-phosphorous copper anode is used, an anode bag with raised insides is required. If an insoluble anode is used, use of a neutral diaphragm is preferred.