

Eco-recycling of Precious Metal from E-waste

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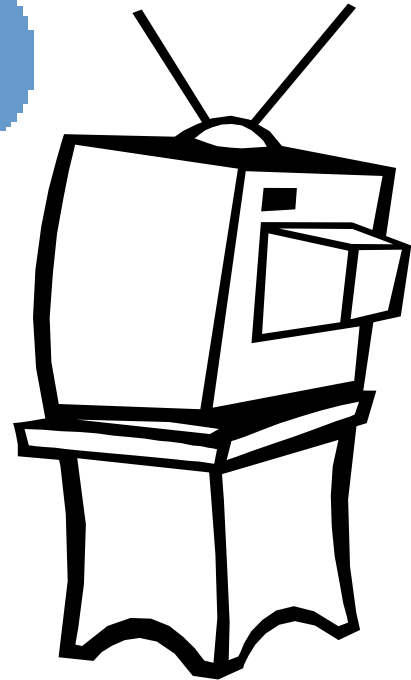
ELECTRONICS RECYCLING ASIA
November 11 – 14, 2014, Singapore
organized by World Recycling Forum

Agenda

1. Introduction of Urban Mining
2. Global Consumer Electronics Sales Situation
3. Eco-friendly Tin Stripping Method
4. Innovative Eco-friendly Gold Stripping Methods



IMAGEING





What happened to them ?

We hope They are.....



Actually They are...

Untreated e-wastes cause a serious polluted environment



- Thousands of Asia workers have been dismantling electronic trash with chisels and cutting torches since the 1980s, many cities in Asia have turned into favorite dumping grounds for e-waste from the West.
- Acid baths and open burning are commonly used to separate precious metals from circuit boards causing the serious air pollution and wasted water problems.

1. Introduction of Urban Mining

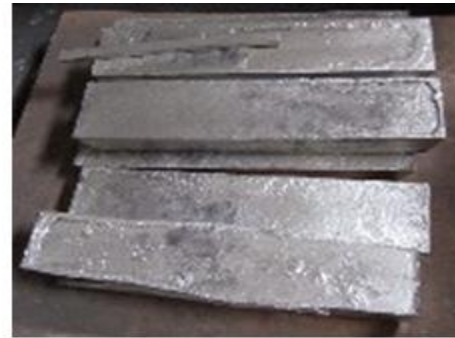
“Urban Mining” --- urban mining is a concept of recycling metals by extracting them from electronic waste. These include Gold, Silver, Palladium, Tin and others valuable metals.



Gold(Au)



Palladium(Pd)



Tin(Sn)



Platinum(Pt)

2004 ~ 2014 Gold Price Graph



Gold(Au)



Aluminum(Al)



Copper(Cu)

Precious metal	date	Price (USD/Oz)
Au	2014/10/2	1211.75
Ag	2014/10/2	17.09
Pt	2014/10/2	1273
Pd	2014/10/2	782
Basic metal	date	Price (USD/Kg)
Al	2014/10/2	1.86
Cu	2014/10/2	6.69
Ni	2014/10/2	16.56
Sn	2014/10/2	27.27
In	2014/10/2	717.5



Nickel(Ni)



Indium(In)

2. Global Consumer Electronics Sales Situation

Unit : million units

Types	2013	2014	2015
PC(Desktop and NB)	296.1	276.7	263.0
Ultramobile	195.4	270.7	350.0
Cell phone	1807.0	1895.1	2000.9
Wearable electronics and others	21.1	37.2	62.0
Total	2319.6	2479.8	2675.9



E-waste Recycling



Precious metals
Basic metals
Rare earth metals



Electronic wastes



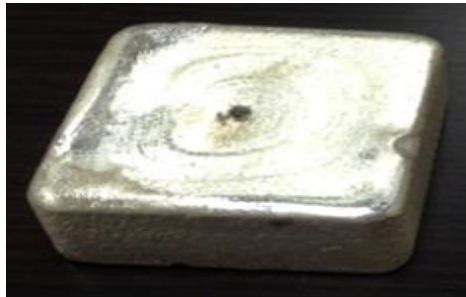
Pollute the environment

Traditionally, people used two basic methods to recycle e-waste: burning and acid dissolution.

- **Burning**--- burning produced a lot of particulates and toxic chemicals includes dioxin, causing serious air pollution.
- **Acid Dissolution**--- using nitric acid or aqua regia to dissolve the precious metals, and dumping waste water without treatment, causing serious water pollution.



Innovative Eco-friendly Metal Stripping Methods



Silver



Gold



Indium

3. Eco-friendly Tin Stripping Method

“Tin recycling technology of waste PCB” was honored with Taiwan EPA’s innovative project. (2013)

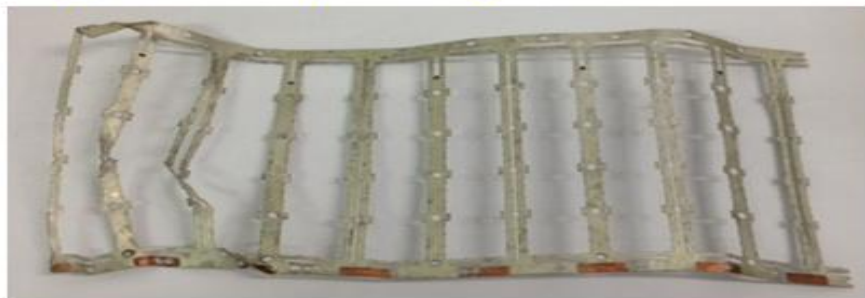
“Tin Stripping Additive and Application Thereof” has submitted the invention patents in Taiwan, USA, and China. (2014)

Parameters	Range	Optimal condition
68% HNO ₃	200-400 ml/L	250 ml/L
SnST-550A Tin stripping additive	200-400 ml/L	250 ml/L
Reaction Temp.	15-60°C	30°C
Tin saturation	160~200 g/L	

SnST-550A Tin stripping additive

Composition	< 10% Surfactant < 20% Metal inhibitor > 80% Water
pH	7.0~8.0
Density	1.0~1.1

<Exp. I—Tin plating on the Cu substrate>



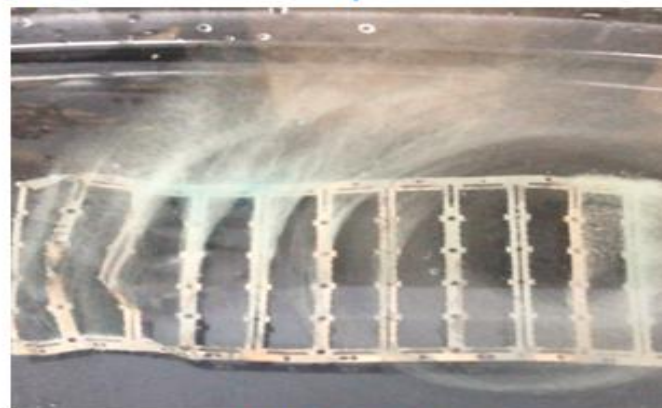
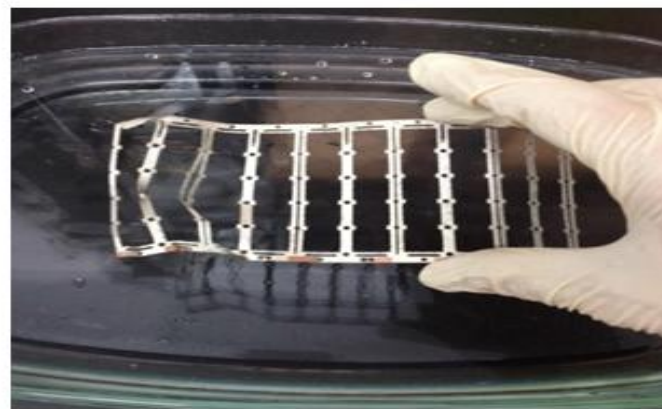
Before Tin stripping



After Tin stripping



68% HNO₃
(250 ml/L)
+
SnST-550A Tin stripper
(250 ml/L)
+
H₂O
(500 ml/L)



25°C, 2 min

<Exp. II---Waste PCB desoldering>



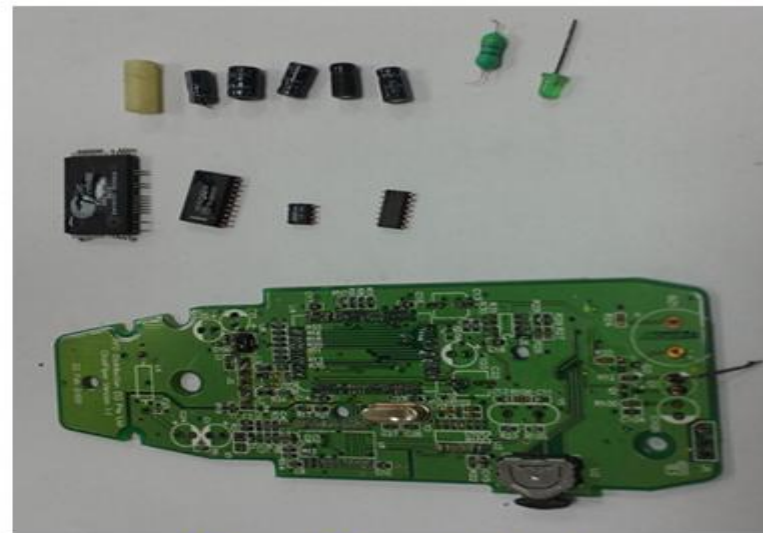
Before Tin stripping



68% HNO₃
(250 ml/L)
+
SnST-550A Tin stripper
(250 ml/L)
+
H₂O
(500 ml/L)



25°C, 10 min



After Tin stripping



<Exp. III---Waste PC motherboard desoldering>



Before Tin stripping

68% HNO₃
(250 ml/L)
+
SnST-550A Tin stripper
(250 ml/L)
+
H₂O
(500 ml/L)



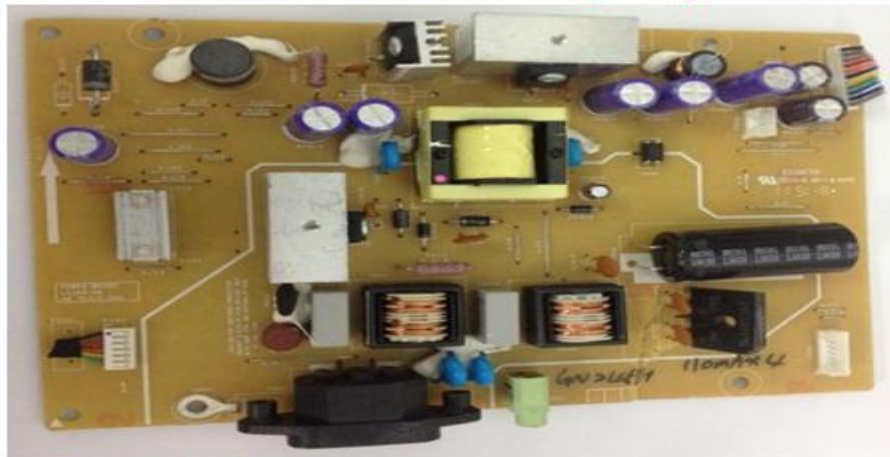
25°C, 40 min



After Tin stripping

<Exp. IV---Waste appliance board desoldering>

Before Tin stripping



After Tin stripping



68% HNO₃
(250 ml/L)

+

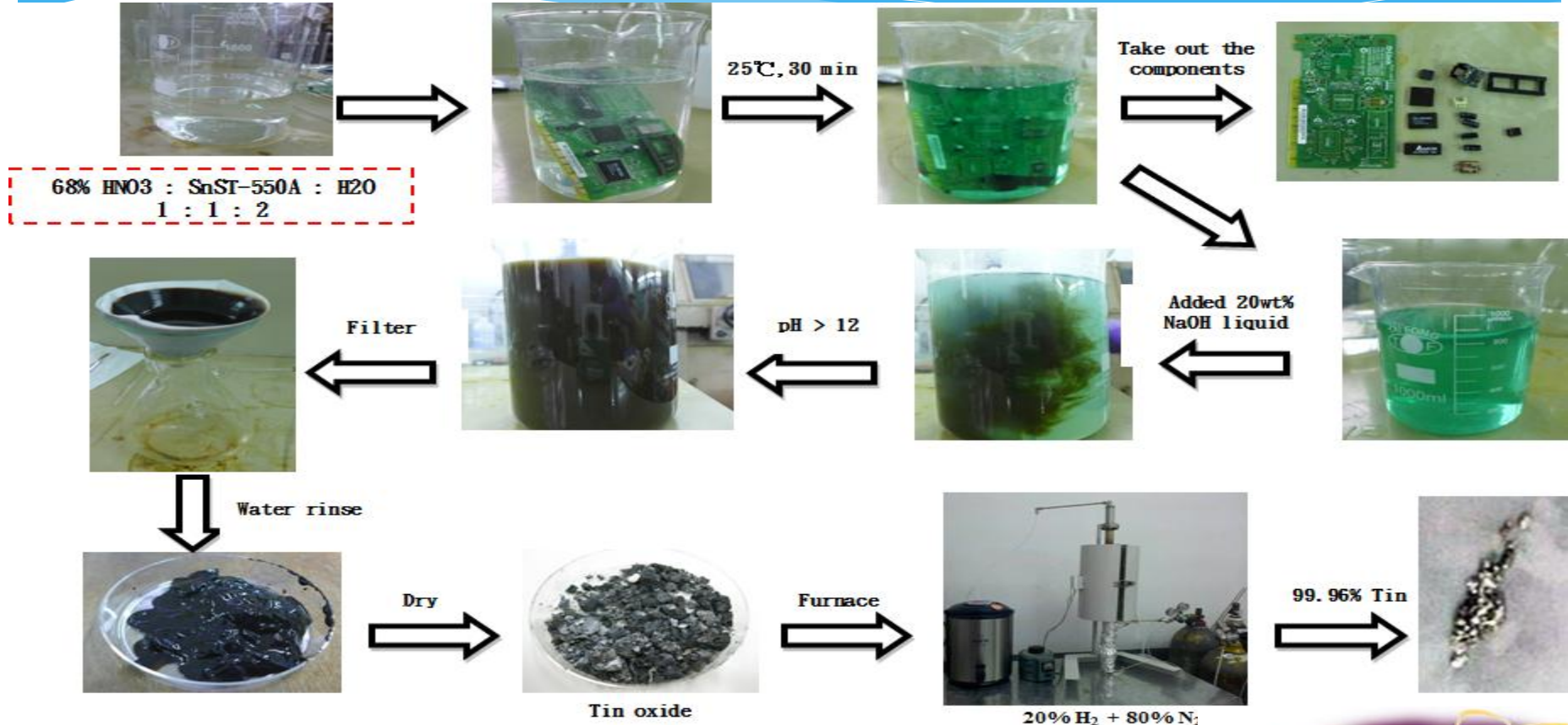
SnST-550A Tin stripper
(250 ml/L)

+



H₂O
(500 ml/L)



25°C, 40 min

Tin stripping and purifying process



4. Innovative Eco-friendly Gold Stripping Methods

Classification	Composition	Corrosiveness	Effect	Method	Rate of stripping	Safety
 Aqua Regia	HCl + HNO ₃	High	Substrate destroyed totally	Chemical method	Slow	Dangerous
 Cyanide	NaCN + Lead acetate	Low	High toxic	Chemical method	Moderate	Dangerous
UW-700 Electrolyte Gold stripper	Sulfide mixture	Neutral	Non-effect on substrate	Electrolysis method	Fast	Very safe
UW-860 Gold stripper	Citrate mixture	Low	Slight effect on substrate	Chemical method	Moderate	Much safer than Aqua Regia and Cyanide

Classification	Au conc.	Purification rate	Cost	Waste Water Treatment
 Aqua Regia	< 0.5 g/L	Slow	Low	Alkali neutralization treatment
 Cyanide	0.6~0.8 g/L	Moderate	Low	Need to break the cyanide, and need to consider lead contamination
UW-700 Electrolyte Gold stripper	5~7 g/L	Fast	Very low	Without any treatment
UW-860 Gold stripper	1~3 g/L	Moderate	Low	Alkali neutralization treatment

UW-700 Electrolyte Gold stripping

“Eco-friendly of Gold stripping technology” was honored with Taiwan EPA’s innovative project. (2014)

(Taiwan Invention Patent: I 426157
USA and China are submitted)



2014 USA Pittsburgh International Invention Exhibition(Gold Medal)

Before Gold Stripping

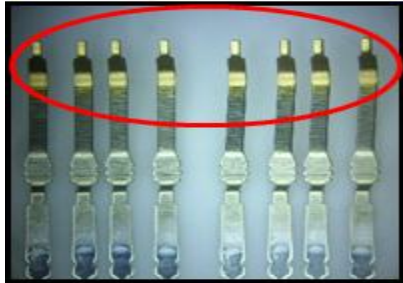


After Gold stripping

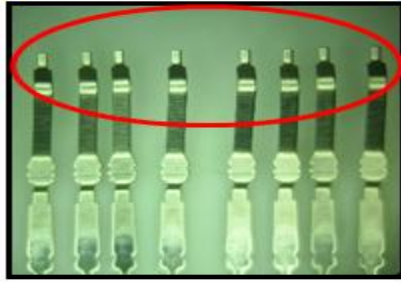


UW-700 Electrolyte Gold stripping Method

Before Gold stripping



After Gold stripping



Before Gold stripping



After Gold stripping



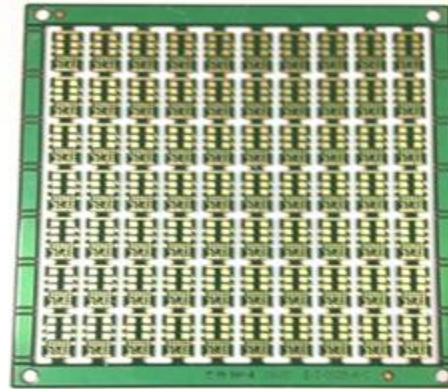
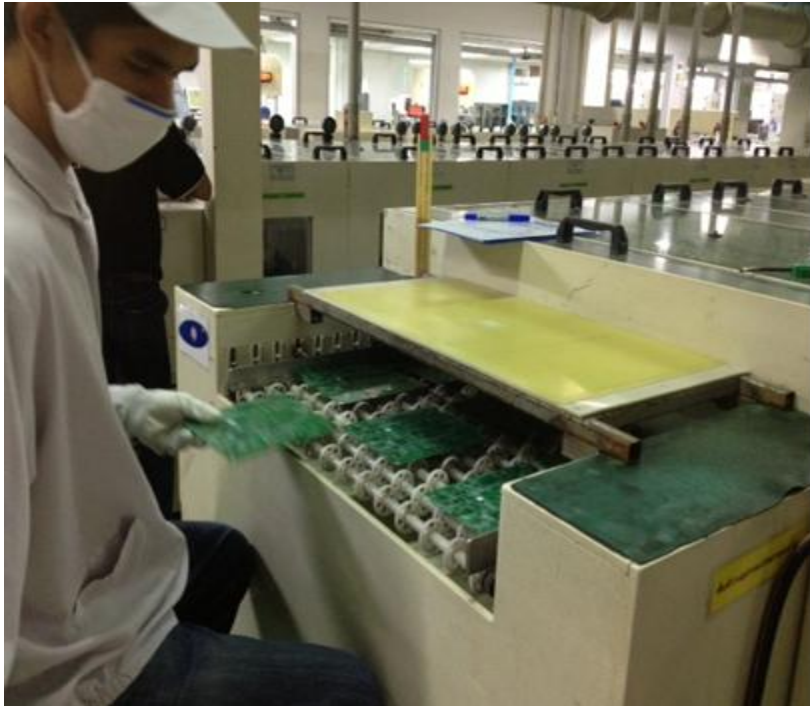
UW-860 Chemical Gold stripping

(Taiwan, USA, Germany, China, Japan Invention Patents are submitted)

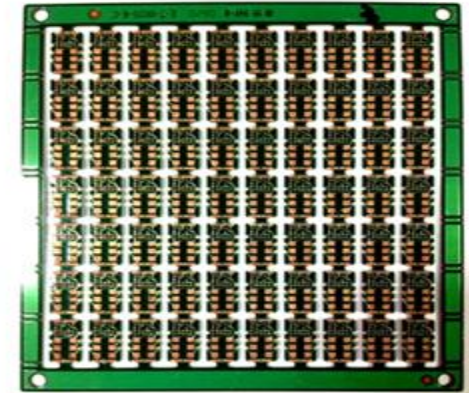


Fortune One

Automatic Continuous Gold Stripping Machine



Before Gold stripping



After Gold stripping

LDS(or MID) with gold plating layer

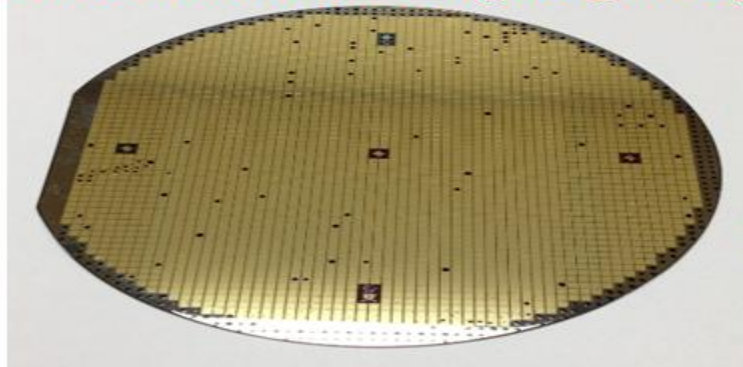


Soaked into UW-860
(30°C , 90 sec)



Gold layer was stripped completely
No damage on the plastic substrate

Semiconductor with gold plating layer



Soaked into UW-860
(30°C , 10 sec)



Gold layer was stripped completely
No damage on the silicone wafer

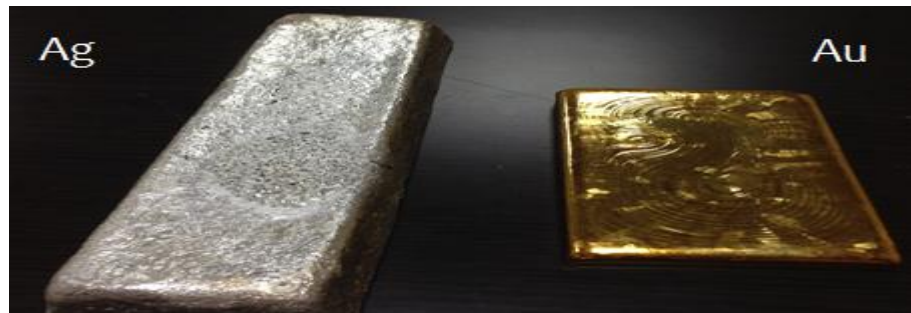
Recycling profit

1 ton of **waste cell phone board** can extract about 400g of Au, 2.3 Kg of Ag, 150 Kg of Cu, and 80 kg of Sn.

Purchase price is about 4,000~5,000 USD Recovery value is about 20,000 USD

1 ton of **waste PC board** can extract about 300g of Au, 1 Kg of Ag, 172 Kg of Cu, and 120 kg of Sn.

Purchase price is about 3,000~3,700 USD Recovery value is about 15,000 USD



UWin got the precious metals from e-waste.

Automatic Eco Stripping Machines



<Fortune one>: Automatic Gold stripping line

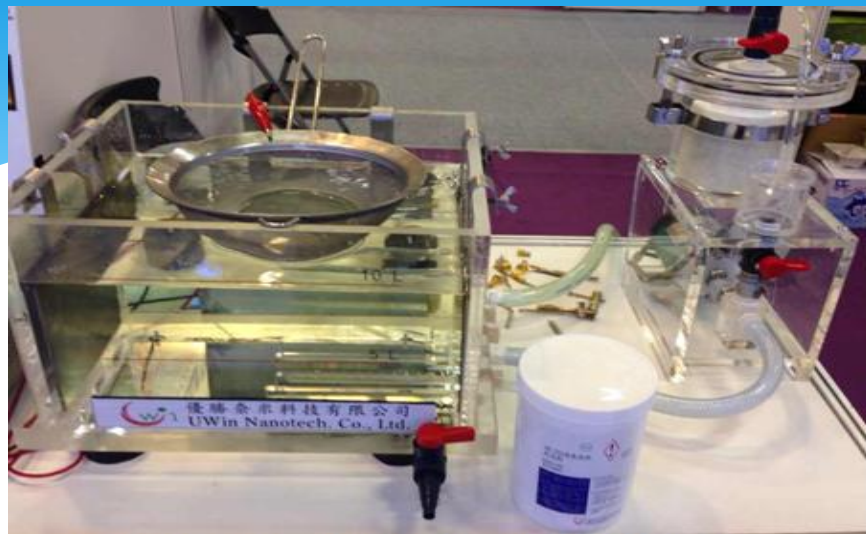


<Rolling one>: Automatic rolling stripping line

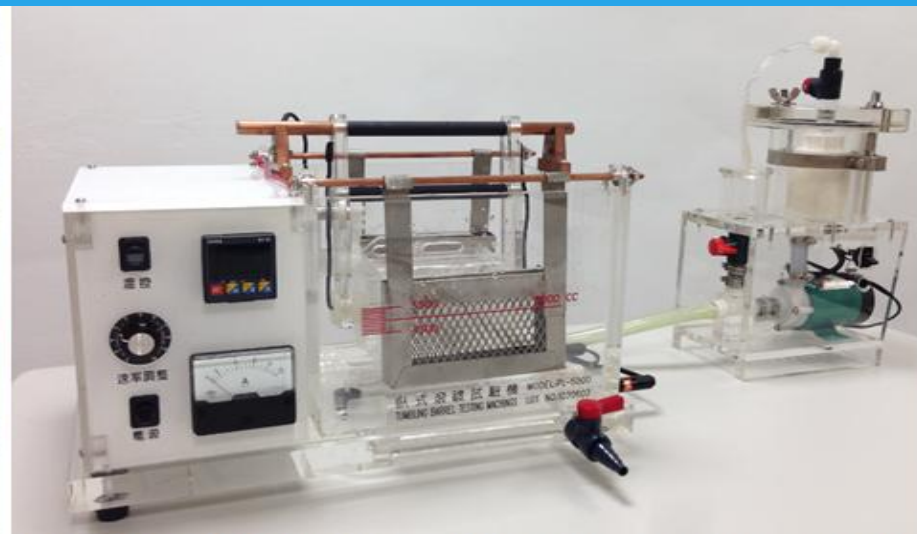


<Iron one>: Automatic electrolyte stripping line

Portable stripping machines



<Catcher one>: Portable stripping machine



<Portable Rolling one>: Portable stripping machine

Before Gold stripping After Gold stripping



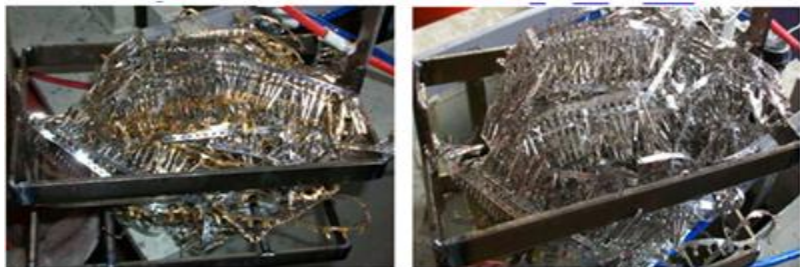
[Introduction of UWin Nanotech.]

UWin is the world's most complete supplier of eco-friendly metal stripping agent. Its project includes : Au, Ag, Pd, Pt, Ni, Sn, Al, Ti, Cu, ITO stripper.

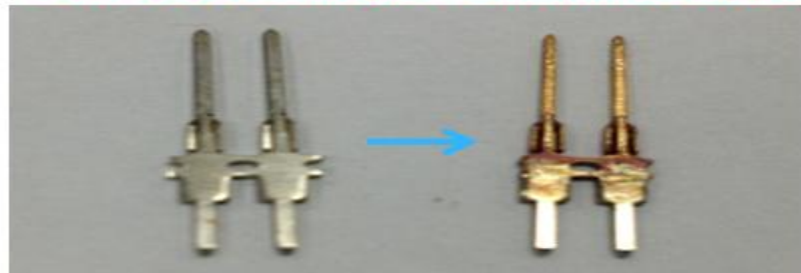
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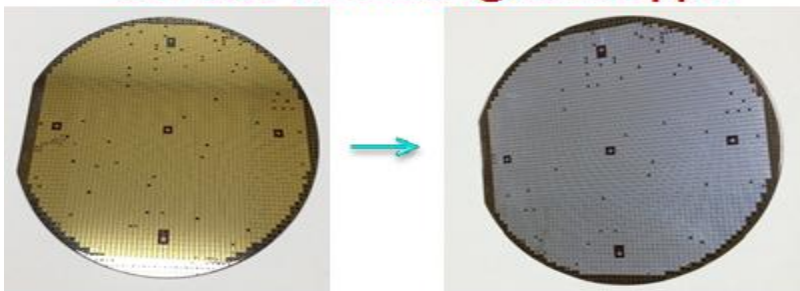
UW-700 electrolyte gold stripper



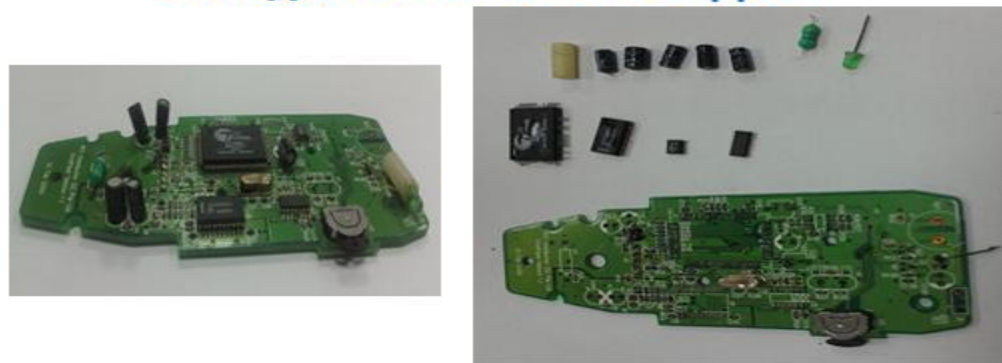
UW-400 electrolyte Palladium stripper



UW-860 chemical gold stripper



SnST-550A chemical Tin stripper



UW-602 electrolyte silver stripper



ITO-900 chemical Indium stripper





The End

Thanks!