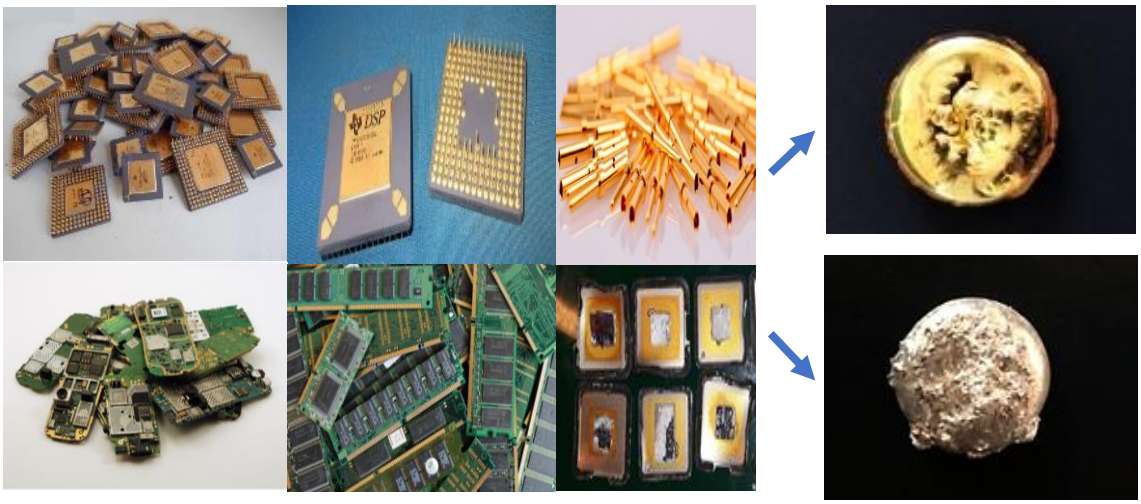
Our New Technology

EWRITS

Electronics Waste Recycling Innovative Technology for Gold and Silver



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Technology

Electronics Waste Recycling Innovative Technology for Gold and Silver (EWRITS)	
Specification	- EWRITS Know How - Technology (equipment[1] and installation) - Training of staff

No.	**Equipment[1]**
1	Component Separation Device
2	Sorting Conveyor
3	Crushing Mill
4	Shredding - Grinding Device (Hammer Mill)
5	Vibrotable - Separator
6	Refining System (Reactor – 350 L Capacity; Precipitation Cells – Set of 3 Washing System; Scrubbers; Collection Tank (2 units)
7	Wastewater Neutralization System – 400 L
8	Assay Cabinet incl. Fume Scrubbers with Fan
9	Decanter Centrifuge – 30 L
10	Laboratory Decanter Centrifuge – 3 L
11	Galvanic Bath - 300 L
12	Laboratory Vacuum Filtration Equipment
13	Induction Furnace (Up to 1200 C)
14	Drying Oven (min. up to 700 C)

Description

JSC Elektronikos Perdirbimo Technologijos (EPT) presents a novel technological chain **EWRITS** designated for **SMEs active in WEEE** (waste electric and electronic equipment) collection, and/or recycling.

The cutting-edge **efficient and environmentally friendly** way for gold and silver leaching and recovery was developed.

The leaching of gold is **selective**, allowing to retain an essential percentage of based metals in the scrap and transferring them to other recyclers.

The novel technological chain is a **science-based integrated chain** of mechanical and chemical stages and may be installed even in the **small and medium enterprises** (SMEs).

The designed reactor of technological chain can be **smartly adapted** to treat efficiently up to 850 kg per month of WEEE.

The chain EWRITS is designed to recover gold and silver from all types of WEEE independently of the content of copper, tin, lead and other metals in the scrap.

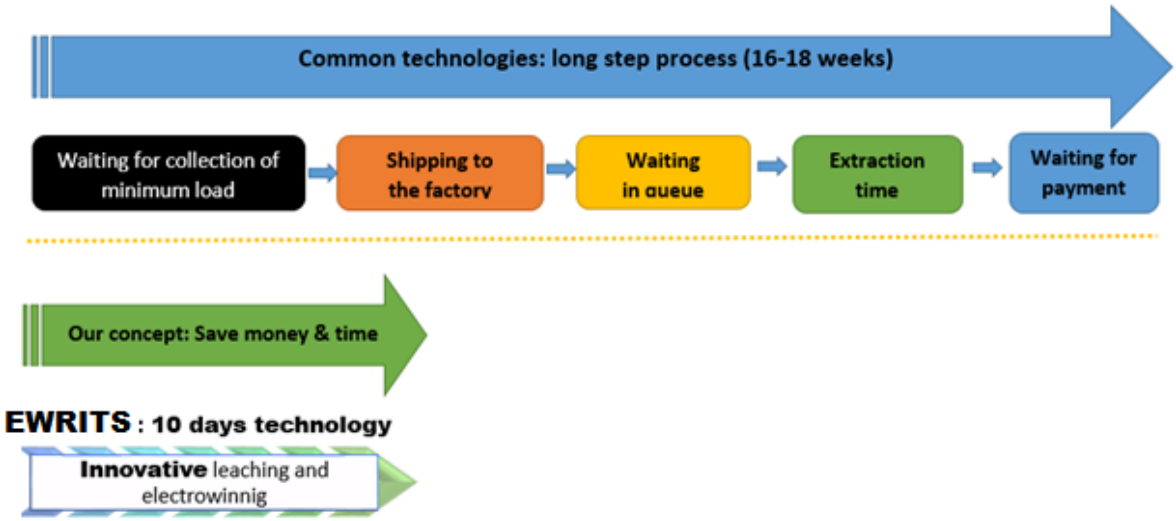
THE PROBLEM:

- ✓ Electronic waste - one of the fastest growing streams of waste (3-5% annually) causing increasing environmental problems
- ✓ Contains hazardous waste and requires special disposal procedures and significant ongoing investment into the infrastructure
- ✓ Has small amount of valuable semiprecious and precious metals that is difficult to extract
- ✓ Recycling companies with the appropriate equipment and capacity only accept large quantities of electronic waste
- ✓ Proper recycling creates huge economic opportunities as all metals emitted per ton of waste can cost €30 000 - €40 000

THE SOLUTION:

- ✓ Faster to deploy and adapt, requires less investment in equipment and maintenance
- ✓ Reduces the costs of logistics, storage and transportation of electronic waste
- ✓ Allows smaller batches of electronic waste to be recycled quickly and efficiently
- ✓ Allows to sell the extracted precious metals as soon as they are extracted, thus minimizing the risk of fluctuations in price
- ✓ Clean, environmentally friendly and safe

You are losing money on logistics, transportation, while your assets are frozen. Chose better!



You control the process		
You **control** the extraction, so you **know** an exact content of gold is in your raw material	You do not lose the gold by mixing rich-Au with less-Au components to attain the minimum load per factory requirements.	A more effective extraction! Proven!

A comparison of the recycling process in proposed facility vs other providers (e.g. in Germany)

	Min. delivery (kg per lot)	Recycling and Au extraction period	Pricing model
EWRITS	**5-10**	**10 days**	**System installation costs**
Other providers	1000	16-18 weeks	• Transportation • Processing cost • Refining cots

Newly developed innovative technology

- It is productive, economic, efficient, optimal and adapted for extraction of precious metals (Au an Ag)

Productivity Indicators of Two People Working Full Working Day

Reactor capacity, kg of WEEE	Treatment efficiency, kg/month
50	650-850

Types of treated waste

EWRIT is designed to recycle materials that have become electronic waste:

- ✓ Ceramic processors
- ✓ Textolytic processors
- ✓ Telephone boards
- ✓ Gold-plated connectors or other Au / Ag coated parts (e.g. transistors, Au / Ag coated metal parts)
- ✓ Computer RAM cards
- ✓ Computer motherboards
- ✓ WEEE containing (coated) Au / Ag (telecommunication boards (KVANT, KVARC and similar station boards), microchips coated with Au / Ag, microchips containing Au and other similar electronic wastes containing Au and Ag)

Equipment for mechanical and chemical treatment of WEEE

EWRITS is delivered with the following equipment, which is designed for mechanical and chemical processes.

Component separation device

The component separation device is designed to mechanically separate the components from the printed circuit board. At the start of the operation, the cylinder in the housing of the component separation device is heated to 230 °C. When the cylinder is heated, the internal shell rotation function must be activated. Then, when the required temperature of 230 °C is reached, the shell opening is opened and ~50 pcs. of the circuit boards (~40 kg) are placed in and for ~8 minutes the process of separating the components from the printed circuit boards takes place.

The separated components fall into the opening at the bottom of the component separation device and are lifted onto the sorting conveyor, where the manual separation of the components continues. A cleaned printed circuit board falls from the back of the shell of the component separation device into the metal trolley when the door is opened. Printed circuit boards cleaned of components can be further recycled to extract Cu and plastics.

Sorting conveyor

The sorting conveyor is used to sort manually the components separated from the printed circuit. The aim of this process is to separate those components that will be used in the further process for the extraction of precious metals. Here such pieces also are separating which will no longer be used in the process. The components separated and suitable for the extraction of precious metals are conveyed by a screw conveyor to a hammer mill, where the components are ground to a certain fraction, based on the sieves used.

Crushing mill

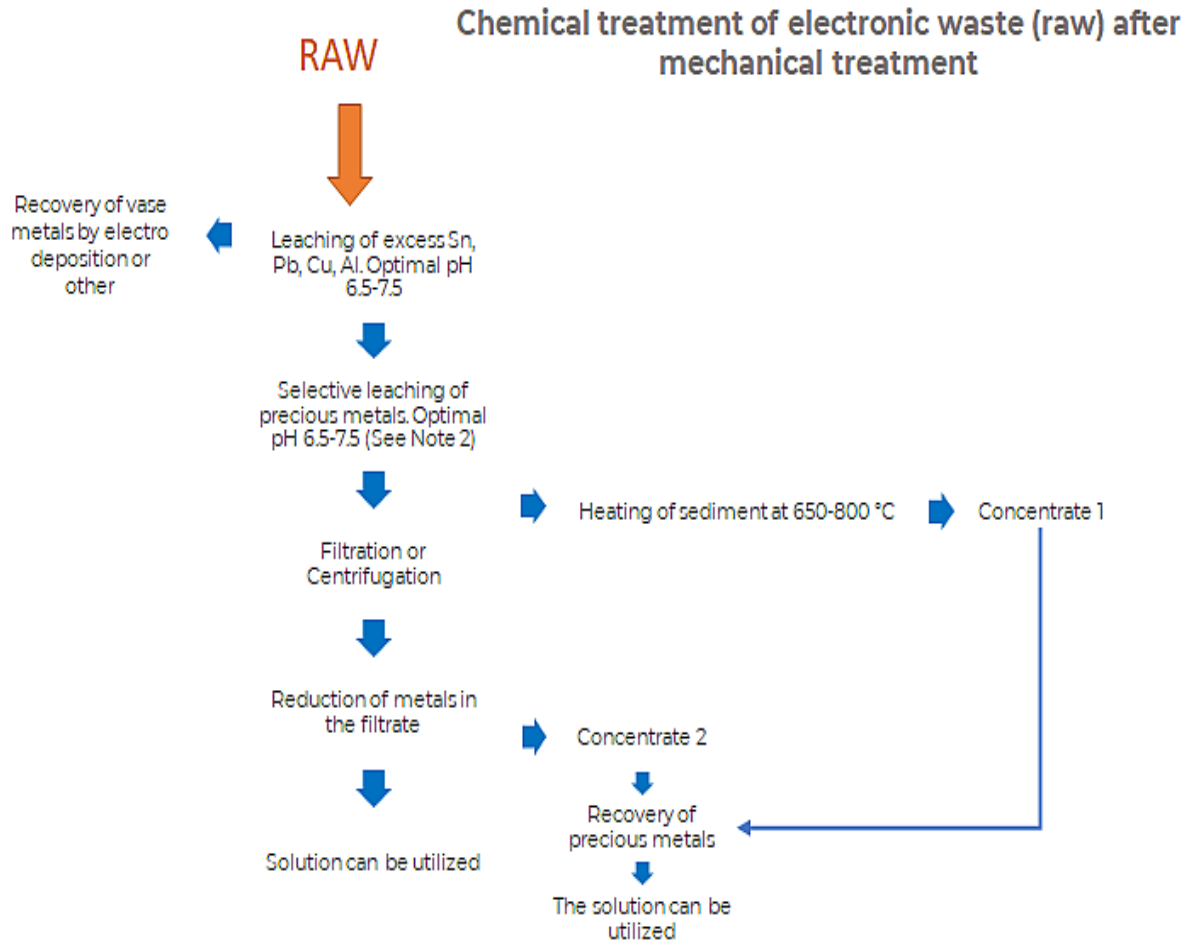
The crushing mill breaks printed circuit boards, telephone boards and similar raw materials for electronic scrap to a certain fraction (0.5-5 cm). The crushed raw material is further processed at later stages.

An example of crushed raw material

Shredding - grinding device (Hammer mill)

The hammer mill is designed to grind those components that have been separated further extraction of precious metals. At the end of the grinding of components, the powder flows into a smaller screw conveyor connected to the Hammer Mill, which raises the powder into a vibro table–separator.

Main chemical recovery steps



Refining machine

Refining machine consists of rotating reactor, vacuum filtration units, tanks, scrubbers.
It is designated to carry out main chemical processes in order to obtain leachates from the batch of treated raw.

Wastewater neutralization unit

This unit is designated to neutralize acidic solutions, to sediment all based metals prior to drain into sewerage.

Assay Cabinet incl. fume scrubbers with fan (Laboratory fume cupboard)

The laboratory fume cupboard is used for work in which the volumes of materials and solutions used are relatively small. The dimensions of the laboratory fume cupboard depend on the customer's request.

Filtration units – centrifuges

The filtration unit / centrifuges are used to separate the sediments (hardly filtered by vacuum filters) from the solutions.

Galvanic bath

The galvanic bath consists of tank with electrodes (cathodes and anodes). It is equipped by pumps, heater, DC power supply unit. It is used to electrowin of base metals (Cu, Sn, Pb) from environmentally friendly solutions.

Laboratory vacuum filtration equipment

The laboratory vacuum filter apparatus is used for filtering solutions

Induction furnace

The induction furnace is used for the smelting of precious metals extracted with EWRITS. At the end of the smelting process, Au or Ag castings are obtained.

Drying oven

An electric oven is used to dry or heat materials, obtained concentrates, other waste and materials. EWRITS recommends the oven with a chamber capacity of 50 liters.

Description of processes

The electronic waste recycling process consists of the following stages:

- Mechanical grinding and other preparation of raw materials for chemical treatment
- Chemical pre-treatment of raw materials
- Selective Au / Ag dissolution
- Production of Au / Ag concentrate
- Production of Au / Ag alloy (96-98%)
- Production of purified Au to 999 and purified Ag to 999

Mechanical grinding and preparation of materials for chemical treatment

Different types of material can be used for the chemical separation of Au / Ag:

- not crushed (ceramic, textolytic processors, various gilded parts, etc.);
- shredded (crushed plates, etc.);
- ground (printed plates with precious metals inside).

For the chemical separation of Au / Ag, it is most efficient to use unground and crushed / ground (mechanically treated) raw material up to 0.5-2 cm in size and containing Au / Ag.

Chemical pre-treatment of raw materials

This stage is recommended, if raw material contain large areas of exposed copper and/or tin. The primary chemical treatment of the raw material is applied to the crushed and ground raw material, which contains a relatively large number of soldered areas.

The chemical leaching process is carried out in the reactor in an environmentally friendly solutions using readily available and inexpensive oxidizers; process temperature 60-80 °C, duration - 2-3 hours.

After 2 h the solution is discharged from the reactor into a plastic container and allowed to settle so that it can be reused or poured into a galvanic bath for the electrolysis of base metals.

Production of concentrate and final production of Au/Ag

This stage applies to all types of raw materials: not crushed; crushed; grounded.

After leaching of precious metals from the batch of WEEE, the obtained solutions are poured into one plastic container. It will contain a corresponding amount of Au / Ag depending on the Au / Ag content in the raw material (e.g. if the textolite processors contain 0.2 g Au / kg raw material, then the Au concentration in the solution would be 0.06 g / L).

As the Au / Ag concentration in this solution is relatively low, in order to maximize the recovery of Au / Ag, it is first necessary to prepare an Au / Ag concentrate by reducing the soluble Au / Ag compounds. The precious metals along with other reducing compounds are reduced, and obtained sediment is collected on the filter and heated at ~700 °C. It is a concentrate.

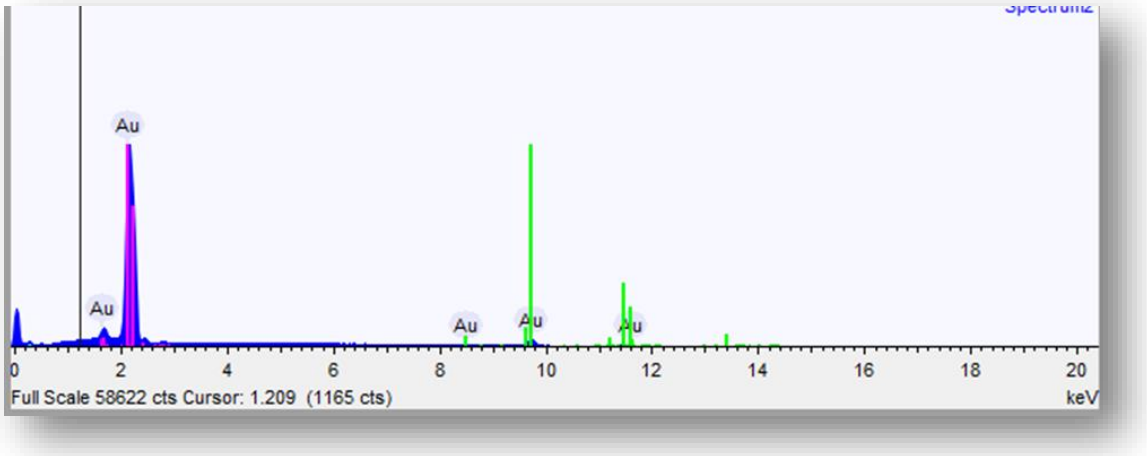
Then Au/Ag can be recovered from the concentrate in the laboratory fume cupboard using acidic route. The waste acidic solutions are neutralized prior drainage in the neutralization unit. The sediment of based metals is dissolved and electrowon in the galvanic bath.

Results

Results (Au)

An example of an obtained 50 g Au casting

Element	Weight %	Weight % σ	Atomic %
Gold	99.99	0.000	99.99

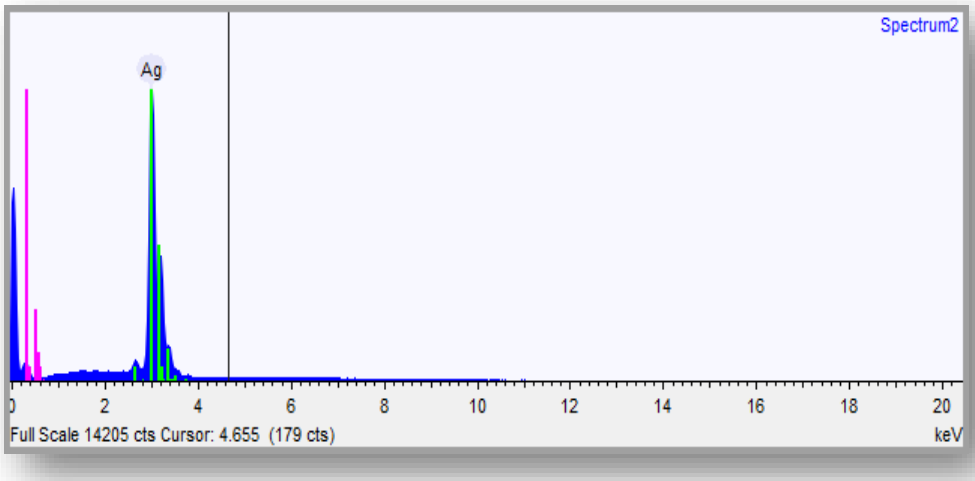


EDS spectrum of the Au casting

Results (Ag)

An example of an obtained 50 g Ag casting

Element	Weight %	Weight % σ	Atomic %
Silver	100.000	0.000	100.000



EDS spectrum of the Ag casting

Recycled electronic scrap (e.g., textolytic processors) can be used as a secondary raw material for Cu

Before Au leaching

After Au leaching and recovery

The main residual component is Cu (>700 g/1 kg of raw)