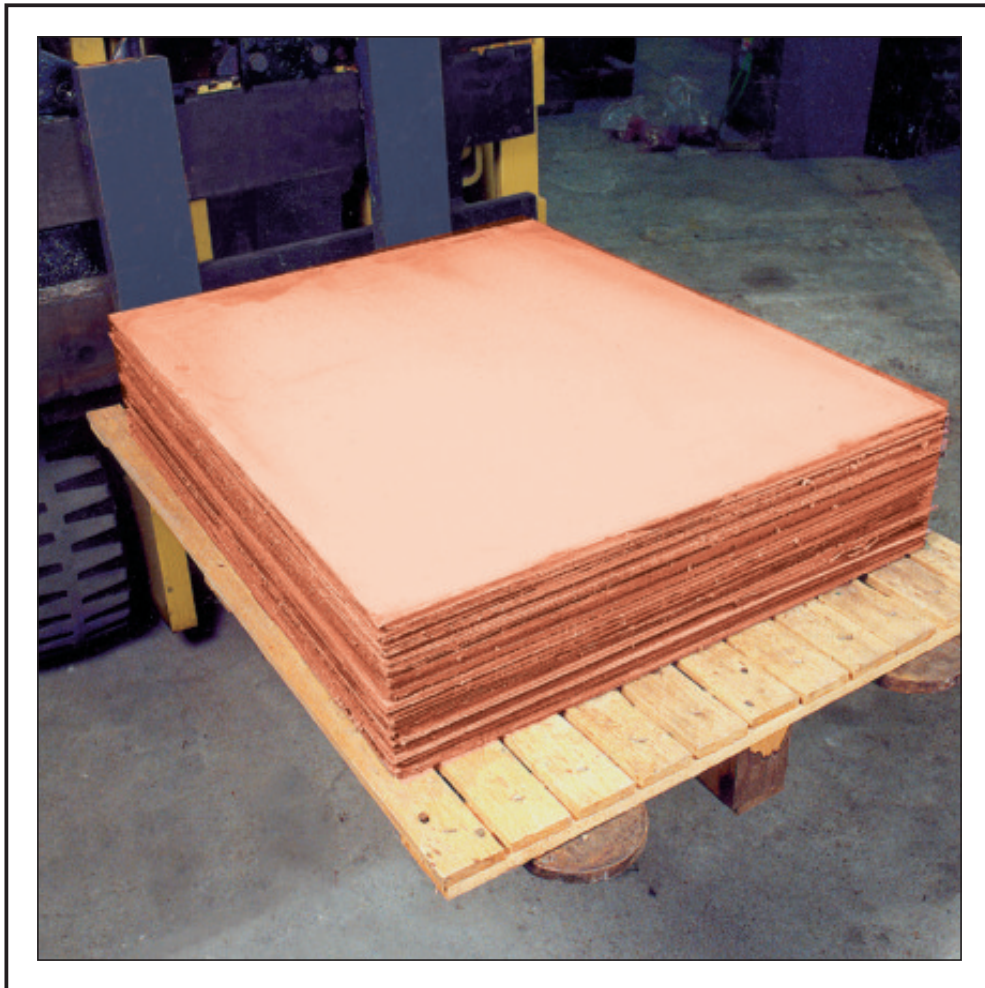


THE ECUPREX PROCESS

A new
Hydrometallurgical-Electrochemical
System to Recover Copper
from Minerals Scrap
and diluted solutions
Cost Effective Low Environment Impact



 **Engitec** Technologies S.p.A.



ADVANTAGE OF THE ECUPREX PROCESS

COMPARED TO SMELTING:

Compared to solvent extraction:

Compared to sulphuric E.W.:

SO₂ emissions are cut because elemental sulphur is produced and neither smelting operations nor sulphuric acid plant are required.

The concentrate grade is not important.

The workplace is cleaner.

Pyrite is unleached and remains in the residue.

The economical figures are attractive:

- Lower capital cost
- Lower operating cost
- Modularity

COMPARED TO SOLVENT EXTRACTION:

No losses of solvent.

No crud problems.

No organic contamination of the E.W. loop.

COMPARED TO SULPHURIC E.W.:

Lower anodic overvoltage

Higher cathodic efficiency

Lower energy consumption

Lower bleed treatment

No mist formation

No cobalt consumption (as CoSO₄)

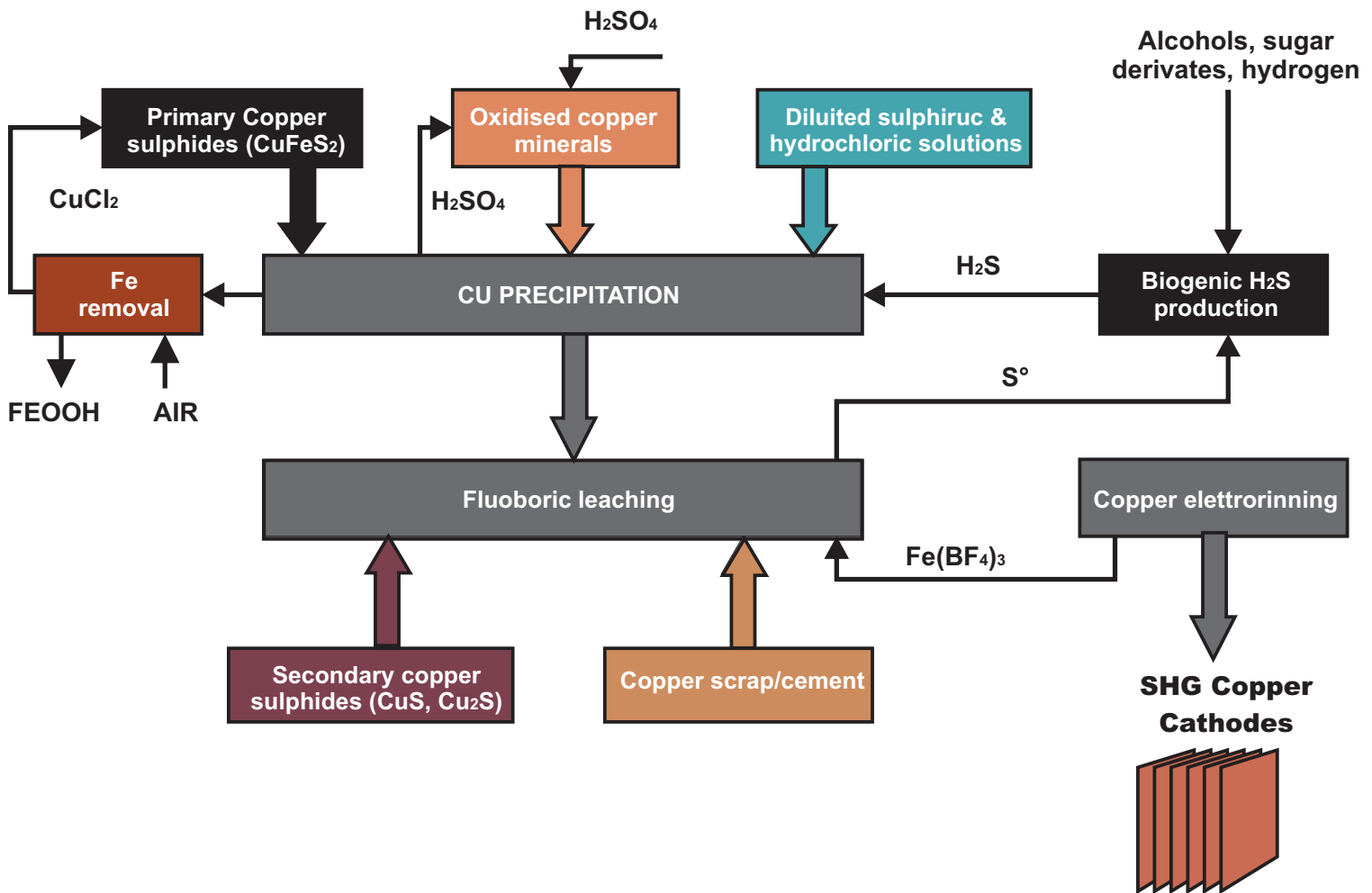
Graphite instead of lead as anode

No lead and sulphur contamination of cathodes

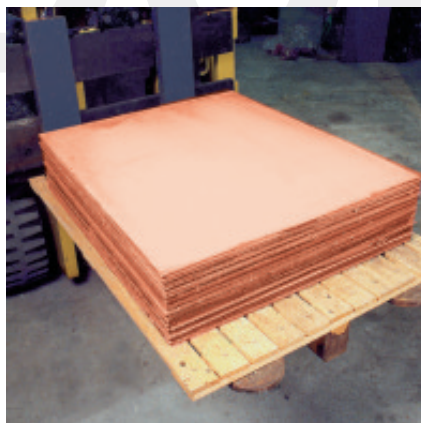


THE PROCESS

ECUPREX



PROCESS



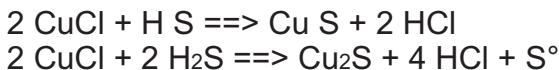
ECUPREX: A NEW CLEAN TECHNOLOGY

This technology, based on a fluoboric E.W., can be applied to the copper bearing materials of different origin.

Here we try to give a general description that can be applied to all the possible feed. The ideal feed to the plant is metallic copper and the primary copper sulphides as CuS and Cu₂S.

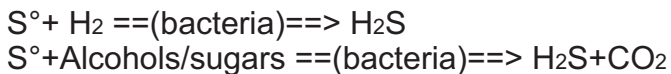
In case of complex sulphide or chalcopyrite based minerals, a pre-treatment have to be run leaching the copper in a chloride solution according to the following reaction:
$$\text{CuFeS}_2 + 3 \text{CuCl}_2 \implies 4 \text{CuCl} + \text{FeCl}_2 + 2 \text{S}^\circ$$

From this solution, as well as from the sulphuric acid based solutions as the heap leaching solution, the copper can be precipitated with H₂S addition according to the following reactions:

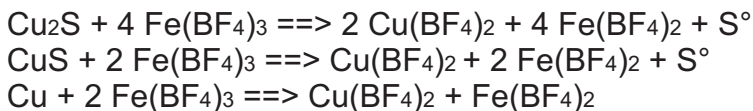


(heap leaching $\text{CuSO}_4 + \text{H}_2\text{S} \implies \text{CuS} + \text{H}_2\text{SO}_4$)

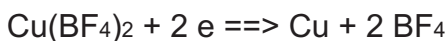
The H₂S is produced by a bacterial reaction starting from the sulphur produced in the fluoboric leaching, as we will see later, according to the following reactions:



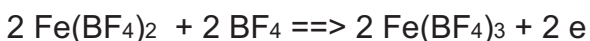
The copper sulphides, or the copper metal are then leached in a ferric fluoborate solution according to the following reaction:



The sulphur produced is fed, as said before, to the bioreactor to be converted in H₂S. The solution obtained is sent to the cathodic compartment of a diaphragm cell where a pure copper cathode is deposited according to the following reaction:



The solution then flows through the diaphragm, to the anodic compartment where the following reaction takes place:



The anolyte is then fed to the leaching reactor closing the fluoboric loop.



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