



# Bioleaching of metals from raw materials and residues

*Copper bioleaching in small scale*

The economical use of resources and efficient recycling processes are important issues for the environmentally friendly yet demand-driven extraction of metals. The demand for metallic raw materials is constantly increasing due to the ongoing development of technologies and consumer goods. The supply of mineral raw materials is also particularly important in the context of the energy transition. The expansion of renewable energies such as wind power and photovoltaics requires a change in the supply of raw materials. Many metals are used in renewable energy systems, with certain

base metals such as aluminum and copper being particularly important. These will also be needed for the expansion of e-mobility, which means that there will be competing demand. Strategic elements such as indium, gallium and germanium are indispensable due to their properties, even if they are only used in small quantities. The recycling of metals conserves raw materials, reduces energy consumption and counteracts short- and medium-term supply bottlenecks. Alternative methods and recycling processes are therefore becoming increasingly important.

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The extraction of metals from their ores by microorganisms is called microbial ore leaching or bioleaching. Specialized microorganisms are used to accelerate the leaching of metals from solids. At the Fraunhofer FEP, this biotechnological process is carried out under defined process conditions. Bioleaching is suitable for metal sulphides that are extremely difficult to dissolve, for residues on mining dumps or even for sludges and ashes. The Fraunhofer FEP uses bioleaching to recover and recycle metals such as copper. Strategic elements such as

indium, vanadium and rhenium can also be mobilized by bioleaching.

Electron beam technology is one of the core competences of the Fraunhofer FEP and has been optimized for many years for numerous novel applications. Low-energy electron technology can be used to treat a wide range of substrates at ambient and room temperature. Recently, a new method for stimulating bioleaching using accelerated electrons has been developed.

## Benefits

- Environmentally friendly biotechnological process to extraction metals from raw materials and residues
- Lower energy consumption compared to conventional extraction technologies
- No generation of greenhouse or toxic gases
- Applications range from metal recycling from heaps to the recycling of industrial residues
- Electron beam technology as a chemical-free process to be used in biotechnological processes

## Our offer

- Validated microbiological laboratory
- Establishment of test regimes for bioleaching of raw materials and residues
- Establishment of test regimes for treatment of microorganisms with accelerated electrons – Validation of bioleaching efficiency using advanced microbiological methods and chemical test procedures
- Feasibility studies for bioleaching of raw materials and residues
- Investigation of the effect of accelerated electrons on the activity of microorganisms

1 *The ELLI 300 electron beam facility for the treatment of bacterial suspensions*

2 *Impedance measuring device for monitoring of bacterial growth*