TECHNOLOGY TRANSFER

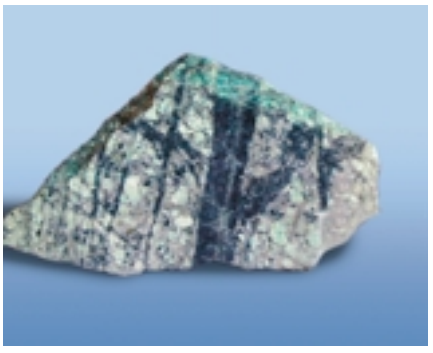
PSI – a partner for industry

Solar Thermal Extraction of Metal from Sulfide Concentrates

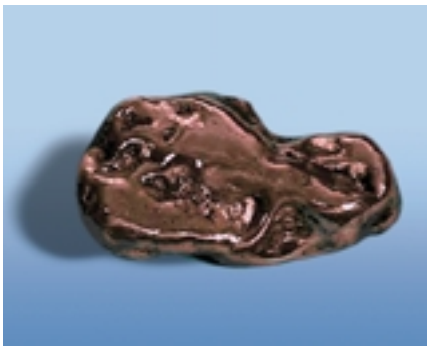
At the Laboratory for Solar Technology of the Paul Scherrer Institute (PSI) a novel approach for extracting metals such as copper or zinc from their sulfides has been investigated. The new concept aims at a technology with virtually zero production of sulfur dioxide (SO_2) and carbon dioxide (CO_2). The technology utilizes concentrated solar radiation to directly convert metal sulfides into the metal and sulfur. PSI is now interested in a partnership for continuing the development and the commercial exploitation of this new approach.

Extraction of Metals

Most of the commercially important non-ferrous metals such as copper, zinc, nickel or lead are mined as sulfides. Conventional processes include partial or complete oxidation of the sulfide to remove the sulfur and subsequent extraction of the metal from the intermediate oxide by a pyrometallurgical or an electrolytic process. The existing procedures are therefore rather tedious and produce toxic and corrosive sulfur dioxide and vast amounts of carbon dioxide. The option of converting the SO_2 into sulfuric acid tends to become less and less attractive due to global overcapacities for this commodity.



Porphyry copper ore with quartz veins.



Pure copper

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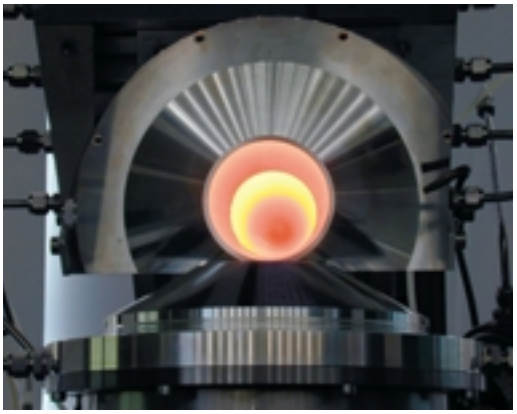
Solar Thermal Extraction

A PSI research group investigated a promising approach to realize the direct conversion of the sulfides to metals. Thermodynamic analyses indicated that many sulfides decompose under inert atmospheres to the metal and sulfur at temperatures in the range of 1300 to 2200 °C. Such temperatures are readily accessible in solar furnaces, which supply the required energy without producing carbon dioxide. Material flow and chemical reactivity considerations revealed a particularly favorable situation for the extraction of copper. Experiments at the Laboratory for Solar Technology demonstrated that a complete separation of copper and sulfur can be achieved at temperatures as low as 1500 °C.



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Advantages of the new method

The new approach provides a facile and economical alternative for the extraction of metals from their corresponding sulfides:

- A direct one-step process
- No generation of polluting and economically unattractive SO_2
- Production of CO_2 can be avoided
- The total energy consumption of the processes can be lowered
- Process improvements lead to a potential of substantial cost savings
- Unique production set-up provides options for elimination of impurities

Next Steps

Our team is planning further steps now, aiming for additional improvements of the process with the ultimate goal of commercializing the new approach. We therefore invite you to discuss partnership options related to this novel solar thermal extraction approach and to the continuation of this project.

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