



EXTRACTING INDIUM FROM POLYMETALLIC ORE DEPOSITS

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Annotation: Indium naturally occurs in ores alongside copper, tin, zinc, and other metals, so its extraction is often carried out together with these metals.

Keywords: indium sulfide (In_2S_3), indium oxide (In_2O_3), ore mining and beneficiation, sulfidation process, hydrometallurgy, electrolysis process.

1. Ore Mining: The most common ores of indium are indium sulfide (In_2S_3) or indium oxide (In_2O_3), which are found together with copper, tin, or other metals in ore form. Therefore, indium is usually extracted during the process of extracting copper or tin. For example, in the Khondiza mines, copper and indium can be found together.

2. Ore Beneficiation: After mining, the ore is cleaned and concentrated. In this process, the main metal (for example, copper) is separated from the other metals mixed with it. During beneficiation, concentrates of copper (or other main metals) are obtained, and the amount of indium present is determined.

3. Copper Extraction: During the process of extracting copper, the ore is melted at high temperatures, and pure copper is separated. In this process, other metals (such as indium) may remain in the smelt (melted form). Indium is usually found in sulfide form together with copper.

- In the copper extraction process, when the ore is melted, copper itself is separated in its pure form (Cu). However, other metals in the ore, such as indium, zinc, or tin, may remain in the smelting residue.

4. Indium Separation: To separate indium from copper, several chemical processes are typically used. When copper and indium are melted together, indium can be separated through the following methods:





- Sulfidation (Flotation) Process: This process ensures the separation of metals in the ore through liquids. To separate indium, copper or other main metals are left in sulfide form, and indium can be separated using other chemical methods.
- Hydrometallurgy: In this method, chemical solutions (such as acidic solutions) are used to extract indium. During this process, indium in the ore separated from copper passes into the solution, and then, through chemical reactions, pure indium can be obtained.
- Electrolysis: Electrolysis can also be used to separate copper and indium. After pure copper is separated from the copper solution through electrolysis, the remaining portion of indium can be separated through an electrolytic method.

5. Obtaining Pure Indium: During the indium separation process, it is obtained in its pure metal form. This is usually in the form of oxide or sulfide, so further chemical processing stages are required to obtain pure indium. Pure indium can be obtained by reducing indium oxide or indium sulfide to metallic indium through chemical reactions.

CONCLUSION

The process of extracting indium from polymetallic ore deposits is carried out as a byproduct during the extraction of copper or other main metals. Chemical processes (sulfidation, hydrometallurgy, electrolysis, etc.) are used to separate indium, and pure metallic indium is obtained. These processes are often based on large-scale copper production in industry because indium is usually present in small quantities, and effective technologies are needed to separate it.

REFERENCES

1. “Extractive Metallurgy of Non-Ferrous Metals” (Author: R. S. Shad, B. A. Zanin) — This book provides an in-depth analysis and information on various polymetallic ores and their separation processes.
2. “Hydrometallurgy: Fundamentals and Applications” (Author: M. R. Stenhouse) — A book dedicated to metallurgy and hydrometallurgy processes, including the technologies for separating valuable metals like indium.

