

IWS 3. Copper ores processing technology

Objective:

This assignment aims to provide students with a detailed understanding of copper ore processing technology. Students will explore various methods of copper extraction, the equipment used, challenges faced in processing, and the applications of copper in modern industries. By the end of the assignment, students should have a solid grasp of the complete copper processing chain.

Instructions:

1. Introduction to Copper and its importance

- Provide an overview of copper, its properties, and its significance in industries such as electronics, construction, and renewable energy.
- Discuss the global demand for copper and its role in the transition to green technologies.

2. Types of copper ores

- Identify and describe the major types of copper ores, such as sulfide ores (e.g., chalcopyrite, bornite) and oxide ores (e.g., malachite, azurite).
- Explain the geographical distribution of copper ore deposits and the primary countries involved in copper mining.

3. Copper extraction techniques

- **Comminution and Grinding:**

Describe the processes of crushing and grinding in copper ore processing. Discuss the equipment used, such as jaw crushers and ball mills, and the importance of particle size reduction.

- **Concentration Methods:**

- **Froth Flotation:**

Explain the froth flotation process for sulfide ores, including the use of collectors, frothers, and depressants. Discuss the significance of pH control in this process.

- **Leaching:**

Describe the heap leaching process for oxide ores, focusing on the use of sulfuric acid to dissolve copper. Include a discussion of solvent extraction and electrowinning (SX/EW) as part of the process.

- **Pyrometallurgical Processing:**

Outline the steps in pyrometallurgical processing, including roasting, smelting, and converting. Highlight the role of the reverberatory furnace and flash smelting in copper production.

- **Hydrometallurgical processing:**

Discuss hydrometallurgical methods, including bioleaching, and how these are used for low-grade copper ores and waste recovery.

4. Case studies

- Select and analyze a real-world case study of copper ore processing. Possible examples include:
 - Escondida Mine, Chile
 - Grasberg Mine, Indonesia
 - Olympic Dam, Australia
 - Aktogay Mine, Kazakhstan
- Describe the specific processing techniques used, the challenges faced, and the overall economic and environmental impact of the project.

5. Challenges in copper processing

- Explore the challenges involved in copper ore processing, such as energy consumption, ore grade decline, and the environmental impacts of tailings disposal.
- Discuss how the industry is addressing these challenges, including advances in waste management and energy efficiency.

6. Sustainability and future trends

- Investigate recent advancements in copper processing technology, including the use of automation, artificial intelligence, and cleaner production techniques.
- Reflect on how sustainable practices in copper processing are influencing the industry's future, particularly in the context of the circular economy and resource recovery.

7. Conclusion

- Summarize the key findings of the assignment.
- Reflect on the importance of copper processing technology in meeting global demand and supporting sustainable development.

Format:

- Word count: 2000-2500 words
- Font: Times New Roman, 12 pt
- Line spacing: 1.5
- Include references and citations.

Submission Date:

04.11.2024 (10th week)

Assessment Criteria:

- Content accuracy and depth: 40%
- Clarity and organization: 20%
- Case study analysis: 20%
- Creativity and innovation: 10%
- Proper referencing: 10%