Faculty of Science and Technology
Common Core of Science and
Mohamed Khider University of Biskra
Technology

Matter : Careers in Science and Technology 2

METALLURGY INDUSTRY PROFESSIONS

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WHAT IS METALLURGY ENGINEERING?

INTRODUCTION

Metallurgy is a branch of materials science and engineering that focus on the studies of the physical and chemical behavior of metallic elements. The science and technology of metals, or how science is applied to the production of metals, as well as the engineering of metal components used in products for both consumers and manufacturers, are all included in the field of metallurgy.

MULTIDISCIPLINARY FIELD

Metallurgists work to understand the physical and chemical behavior of metals, as well as the best methods for shaping, strengthening, and combining them to create alloys for specific purposes.

IMPORTANCE

It involves the extraction, processing, and manipulation of metals from their ores to create usable materials.

Metallurgy plays a vital role in shaping various industries by supplying the materials and processes necessary for the production of high-quality products. Without advancements in metallurgy, industries would face significant challenges in producing the strong, lightweight, and specialized materials required for modern products and infrastructure. Metallurgical innovations enable the creation of materials that meet the demanding needs of these sectors, driving progress and ensuring the performance, safety, and durability of a wide range of applications.

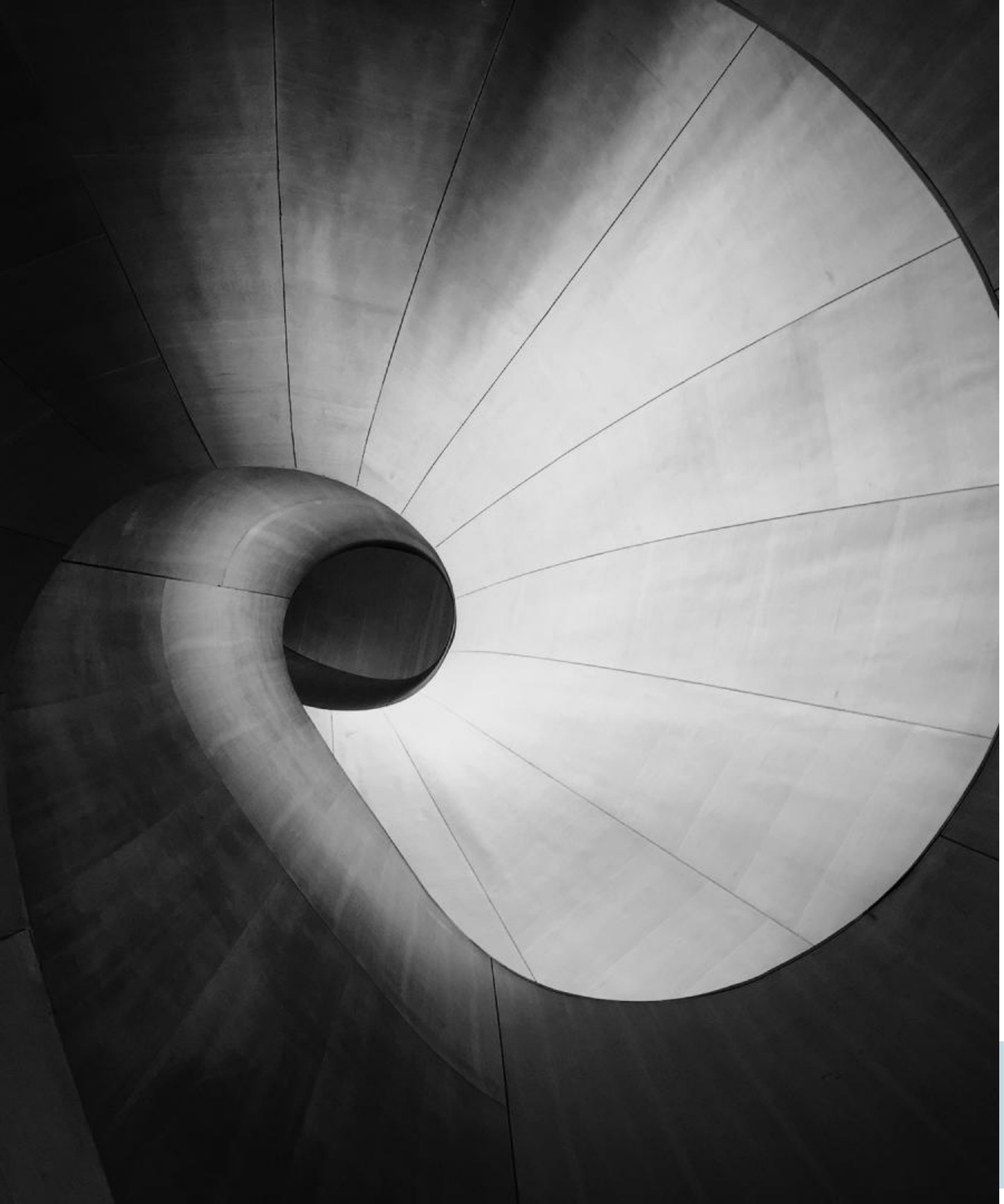
Types of Metallurgy

•**Chemical Metallurgy**
Chemical metallurgy is primarily concerned with the chemical processes that govern the extraction, reduction, and oxidation of metals. It focuses on understanding the chemical behavior of metals, their reactions, and how to process them efficiently and sustainably. Key topics in this area include:

•Metal Reduction and Oxidation
•Mineral Processing
•Metal Extraction
•Thermodynamics
•Electrochemistry
•Chemical Degradation.

Applications of Chemical Metallurgy

- Extractive Metallurgy: Essential in industries where metals like iron, copper, gold, and aluminum are extracted from ores and processed into pure forms.
- Recycling of Metals: Chemical metallurgy is also important in understanding the processes involved in recovering valuable metals from scrap or waste materials.
- Energy Production: Many metal extraction processes involve the use of energy (such as heat or electricity), and understanding the thermodynamics of these processes is critical to making them more efficient.



Physical Metallurgy

Physical metallurgy, on the other hand, is concerned with the study of metals' physical properties and how they behave under various conditions. This includes their response to mechanical forces, temperature changes, and other external factors. The focus is on how the structure of metals at microscopic and atomic levels affects their performance in real-world applications. Key Areas of Study:

- Crystallography
- Material Characterization
- Mechanical Metallurgy
- Phase Transformations
- Failure Mechanisms

Applications of Physical Metallurgy:

- Material Design and Manufacturing: Used in designing and producing materials for a variety of applications, including aerospace, automotive, and construction, where the mechanical properties of metals are critical.
- Heat Treatment: Physical metallurgy is vital for heat treatment processes like annealing, tempering, and quenching, which alter the physical properties of metals to make them more suitable for different uses.
- Failure Prevention: Understanding the failure mechanisms of metals helps in preventing accidents and improving the safety of structures, machines, and vehicles.

Terms involved in Metallurgy

1. Minerals are naturally occurring inorganic substances substances with a specific chemical composition. composition.
2. Ores are specific minerals from which metals can be can be extracted profitably.
3. Gangue refers to the unwanted impurities present in present in ores.
4. Flux is a material added to facilitate the removal of of gangue during the extraction process.
5. Slag is the by-product formed from the combination of combination of flux and gangue, which is separated separated from the extracted metal.

METALLURGY TECHNIQUES:

CRUSHING AND PULVERIZATION

Breaking down ore into smaller particles to increase increase surface area for efficient processing.

CONCENTRATION OR DRESSING OF ORES

Removing unwanted unwanted gangue to to concentrate the valuable minerals.

REDUCTION (EXTRACTION OF METALS)

Reducing metal ores by removing oxygen or other elements, often through smelting or roasting

PURIFICATION OR REFINING OF METALS

Removing impurities from from the extracted metal to to achieve the desired purity, using techniques like like electrorefining or distillation.

CONVERSION INTO OXIDES

Converting metal ores (especially sulfides) into oxides during the reduction process and refining to facilitate further reduction or removal of impurities.

Main manufacturing operations for metal parts

Molding from the Liquid State
Molding is a process in which molten metal is poured into a mold, where it solidifies into the desired shape. This operation is widely used to create complex metal parts with specific geometries that might be difficult or costly to produce using other methods.

Extrusion
Extrusion is a thermomechanical manufacturing process that involves forcing a heated material through a die that has the shape of the desired part's cross-section. The process produces continuous lengths of metal parts that can be cut to size or used as-is, with applications in a variety of industries.

Lamination
Lamination is a metal shaping process where a large plate (either hot or cold) is passed between two rotating cylinders that apply significant pressure to reduce its thickness. This method is primarily used for creating thin, flat metal products such as sheets, plates, foils, and more.

METALLURGY SPECIALTIES

The metallurgy industry is organized into three main specialties:

1. Production of cast iron, steel and ferrous alloys (steel industry);

2. Production of non-ferrous and non-precious metals

3. The production of precious metals (gold, silver,….)

The main employment sectors in metallurgy are:

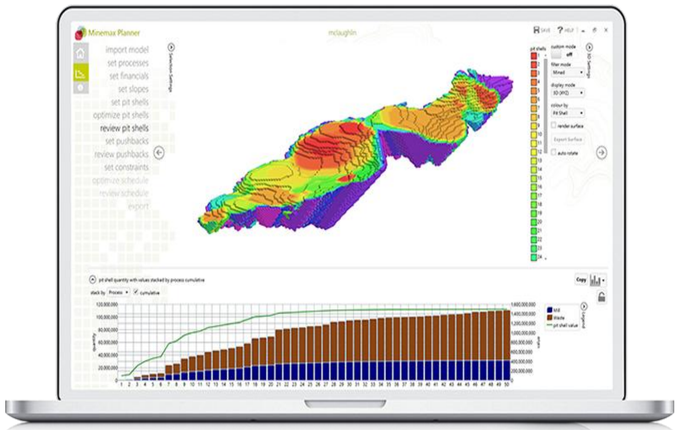
Metallurgical professions

MINING ENGINEERING TECHNICIAN:

A mining technician works in works in various settings including setup, development, exploration, exploration, and mine maintenance.

MINE PLANNER:

He plans and determines the the optimal methods for extracting minerals from the the ground without affecting affecting or hindering any of of the surrounding areas



MINERAL EXPLORER:

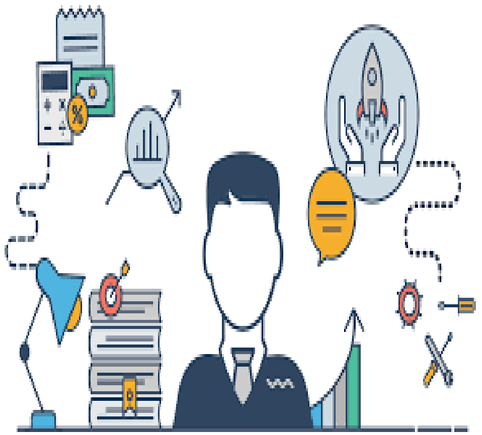
He is responsible for determining the availability, availability, quantity and quality of minerals present, present, and they also evaluate the area to begin the mining process.

GENERAL MANAGER OF MINES:

Takes care of general administrative responsibilities responsibilities during the mining and planning process. process.

The main employment sectors in metallurgy are:

Metallurgical professions

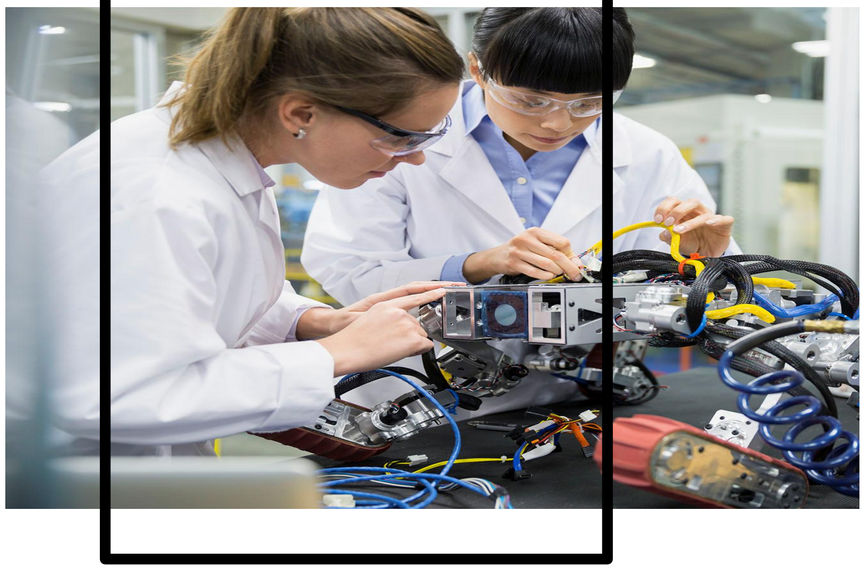


TECHNICAL ADVISOR:

Participates in the process of extracting data that is related to mining work, and also analyzes
and looks at the information stored for the mining process and its areas.

RESEARCH ENGINEER:

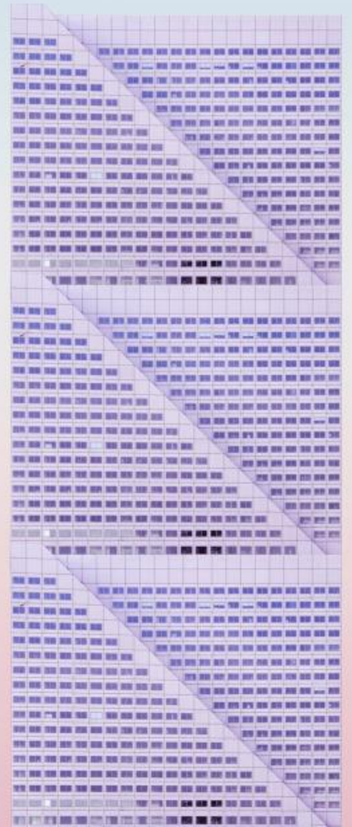
Conducts research on the quality, quantity, and value of minerals that can and have been extracted, and also conducts experiments on minerals and mining areas.

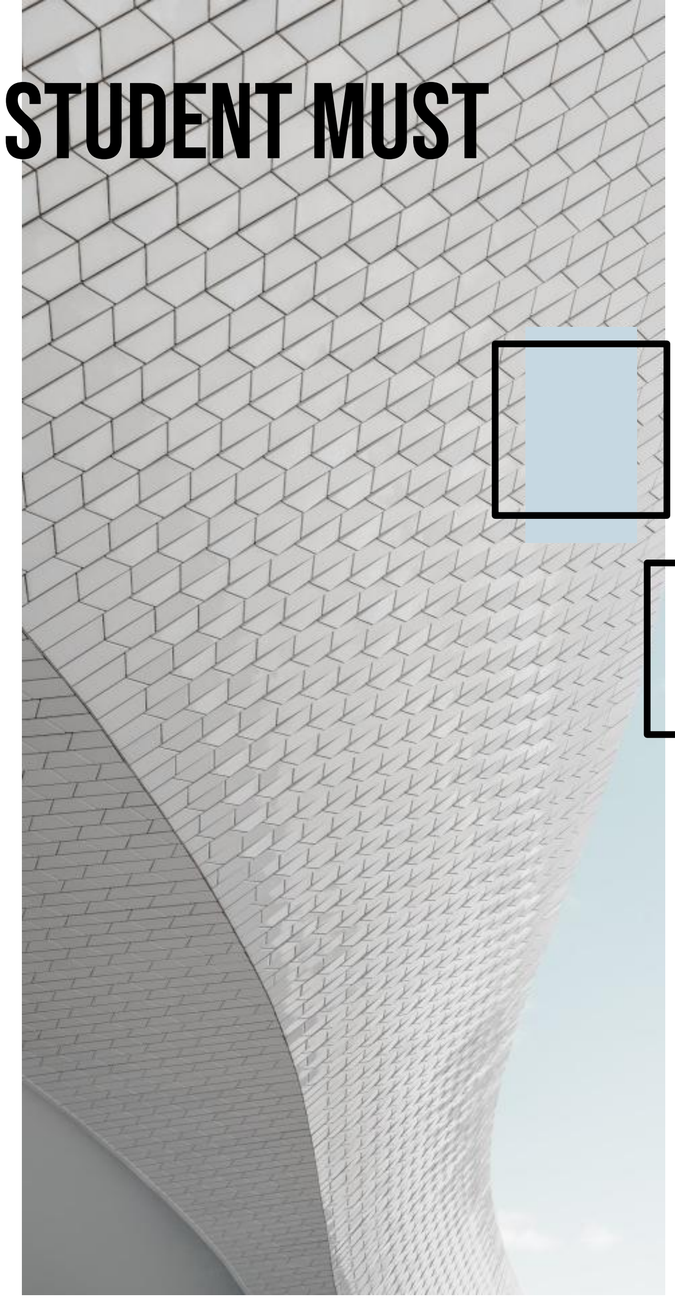


DRILLING ENGINEER:

Determines costs, plans, develops and supervises the the drilling process.

SKILLS THAT THE STUDENT MUST POSSESS





A mining engineer is expected to have the following qualities and skills :

- ABILITY TO PLAN RESOURCE EXTRACTION
- ABILITY TO DESIGN AND USE RELEVANT COMPUTER PROGRAMS
- ABILITY TO IDENTIFY AND SOLVE WORK-RELATED PROBLEMS
- ABLE TO WORK INDIVIDUALLY OR AS PART OF A TEAM
- STRONG ENGINEERING AND MATHEMATICAL ABILITIES