Quadrant II – Transcript and Related Materials

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Notes

Oxide Group

Introduction

The oxide mineral class includes those minerals in which the oxide anion ($O2-$) is bonded to one or more metal ions. The oxide minerals can be grouped as simple oxides and multiple oxides. Simple oxides are a combination of one metal or semimetal and oxygen, whereas multiple oxides have two non-equivalent metal sites. The simple oxides can be subdivided on the basis of the ratio of the numbers of atoms of metal (or other elements) and oxygen, giving general formulas of the A_xO_y type. In such formulas A represents a metal atom, and x and y represent integers. Most commonly occurring minerals are Fe, Mn, Al, Mg, Ti oxides. Chemical compositions then fall into categories such as those designated AO, A_2O, A_2O_3, AO_2.

1] MAGNETITE - Fe_3O_4 [oxide of Fe]

Magnetite is one of the main iron ores, with the chemical formula Fe3O4. It is also the mineral with the highest iron content (72.4%). It is ferri-magnetic; attracted to a magnet and can be magnetized to become a permanent magnet itself. It is one of the few minerals that are attracted to a common magnet.

Physical properties:

Colour:	black to silvery grey
Streak:	black
Luster:	metallic to sub-metallic

Crystal system: cubic
Transparency: opaque
Specific gravity: 5.2(high)
Hardness: 5-6.5

It is the most magnetic of all the naturally-occurring minerals on Earth. Naturally-magnetized pieces of magnetite, called lodestone, will attract small pieces of iron, which is how ancient peoples first discovered the property of magnetism. Lodestone is easily identified because it is usually covered with small particles of magnetite and other magnetic minerals.

Uses: it is an important ore of iron and also used as abrasives. Small amount of magnetite are also used as a micronutrient in fertilizers, as a pigment in paints and as an aggregate in high density concrete.

2] HEMATITE - Fe2O3 [oxide of Fe]

Hematite is one of the most abundant minerals on Earth's surface and in the shallow crust. It is an iron oxide with a chemical composition of Fe2O3. Pure hematite has a composition of about 70% iron and 30% oxygen by weight. Hematite is harder than pure iron, but much more brittle.

Physical properties:

Colour: black to reddish brown
Streak: cherry red
Luster: metallic to sub-metallic
Hardness: 5-6.5
Specific gravity: 5-5.3(high)
Crystal system: hexagonal

Hematite is the world's most important ore of iron. Although magnetite contains a higher percentage of iron and is easier to process, hematite is the leading ore because it is more abundant. Hematite is also used as pigment in paints.

3] CORUNDUM- Al_2O_3 [oxide of Al]

It is an aluminium oxide with a chemical composition of Al2O3, typically containing traces of Fe, Ti & Cr. It is also a naturally transparent material, but can have different colours depending on the presence of impurities in its crystalline structure.

Physical properties:

-**Streak**: Absent (harder than streak plate)
-**Luster:** Vitreous to sub vitreous
-**Transparency:** transparent to translucent
-**Hardness:** 9
-**Specific gravity:** 3.9- 4.1
-**Crystal system:** hexagonal

Uses

Ruby and Sapphire are varieties of corundum and are important gemstones. Ruby is red coloured variety, whereas other colour varieties are referred to as Sapphire. Because of very high hardness and lack of cleavage it is mostly used as abrasives in different industries.

4] Chromite- ($FeCr_2O_4$)

Chromite is an oxide mineral composed of chromium, iron, and oxygen (FeCr2O4). The element magnesium can substitute for iron in variable amounts. Chromite is sometimes slightly magnetic. This can cause it to be confused with magnetite. Careful observations of hardness, streak, and specific gravity are required to distinguish these minerals in hand specimens. Chromite is important because it is the only economic ore of chromium, an essential element for a wide variety of metal, chemical, and manufactured products. Many other minerals contain chromium, but none of them are found in deposits that can be economically mined to produce chromium.

Physical properties of the mineral are:

- It is dark grey to black in colour.
-**Streak:** Dark brown
-**Luster:** metallic to sub-metallic
-**Transparency:** opaque
-**Hardness:** 5.5 to 6
-**Specific gravity:** 4.0- 5.1
-**Crystal system:** cubic

Chromite today is mined particularly to make stainless steel through the production of ferrochrome (FeCr), which is an iron-chromium alloy.