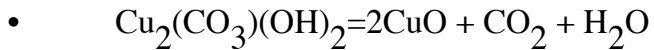


Roasting

In the case of carbonates and sulfides, a process called "roasting" drives out the unwanted carbon or sulfur, leaving an oxide, which can be directly reduced. Roasting is usually carried out in an oxidizing environment. A few practical examples:

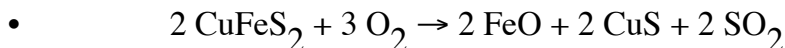
- [Malachite](#), a common ore of [copper](#), is primarily copper carbonate hydroxide

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- This mineral undergoes thermal decomposition to 2CuO, CO₂, and H₂O in several stages between 250 °C and 350 °C. The carbon dioxide and [water](#) are expelled into the atmosphere, leaving [copper\(II\) oxide](#) which can be directly reduced to copper.

- The roasting process is generally undertaken in combination with [reverberatory furnaces](#). In the roaster, the copper concentrate is partially oxidised to produce "[calcine](#)" and [sulfur dioxide](#) gas. The [stoichiometry](#) of the reaction which occurs is:



- Roasting generally leaves more sulfur in the calcined product (15% in the case of the roaster at [Mount Isa Mines](#)) than a sinter plant leaves in the sintered product (about 7% in the case of the Electrolytic Refining and Smelting smelter).

- As of 2005, roasting is no longer common in copper concentrate treatment, because its combination with reverberatory furnaces is not energy efficient and the SO₂ concentration in the roaster off gas is too dilute for cost-effective capture.

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- [Galena](#), the most common mineral of [lead](#), is primarily lead sulfide (PbS). The sulfide is oxidized to a sulfite (PbSO₃) which thermally decomposes into lead oxide and sulfur dioxide gas. (PbO and SO₂) The [sulfur dioxide](#) is expelled (like the [carbon dioxide](#) in the previous example), and the lead oxide is reduced as below.