



Gold Processing White Paper

This white paper is intended to describe the gold mining process explaining the differences between Concentration, Floatation, Smelting, Refining and Melting:

Gold is usually found in a pure state however, it can also be extracted from silver, copper, lead and zinc. Seawater can also contain gold, but in insufficient quantities to be profitably extracted—up to one-fortieth (1/40) of a grain of gold per ton of water. Gold is generally found in two types of deposits: lode (vein) or placer deposits. It is usually extracted from lode deposits by drilling or blasting whereas placer deposits require hydraulic mining, dredging, or power shoveling. Once extracted the gold ore is pulverized to prepare it for refining. ([DOVE sells pulverizing products.](#))

Gold ore is then processed as follows in the following order.

Concentration:

Dry concentration involves the separation and recovery of gold concentrate in dry mode using vibrating tables without the use of water. Dry concentration has many advantages over wet concentrating methods, except when water is actually required as a solvent or when wet working is required prior to concentration and separation. ([DOVE has a Dry Concentrator Dry-TABLE[®]](#))

Floatation:

Floatation involves the separation of gold from its ore by using certain chemicals and air. The finely ground ore is dumped into a solution that contains a frothing agent (which causes the water to foam), a collecting agent (which bonds onto the gold forming an oily film that sticks to air bubbles) and a mixture of organic chemicals (which keep the other contaminants from also bonding to the air bubbles). The solution is then aerated—air bubbles are blown in—and the gold attaches to the air bubbles. The bubbles float to the top, and the gold is skimmed off. ([DOVE sells floatation plants.](#))

STATE OF THE ART IN TECHNOLOGY FOR MINERALS PROCESSING

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Smelting:

Smelting is a method of purifying metals by melting and separating the pure metal such as gold from impurities. In other words Smelting extracts a metal from its ore. Smelting involves heating the gold with a chemical substance called flux. The flux bonds with the contaminants and then floats on top of the melted gold. The gold is then cooled and allowed to harden into molds and the flux-contaminant mixture (slag) is hauled away as a solid waste. (DOVE does not currently have a smelting machine but is developing one which will be available soon.)

Most ores are a chemical compound of the metal with other elements, such as oxygen (as an oxide), sulfur (as a sulfide) or carbon and oxygen together (as a carbonate). To produce the metal, these compounds have to undergo a chemical reaction. Smelting therefore consists of using suitable reducing substances that will combine with those oxidizing elements to free the metal. Smelting uses heat and a chemical reducing agent to change the oxidation state of the metal ore. The reducing agent is commonly a source of carbon such as coke, or in earlier times charcoal. The carbon or carbon monoxide derived from it removes oxygen from the ore to leave the metal. The carbon is thus oxidized in two stages producing first carbon monoxide and then carbon dioxide. As most ores are impure it is often necessary to use flux such as limestone to remove the accompanying rock gangue as slag.

Refining:

The final stage of gold production -- refining -- involves removing impurities that remain after the smelting process. Gold can be in the form of doré bars as well as scrap gold. (A doré bar is a semi-pure alloy of gold and silver usually created at the site of a mine.) The gold alloy is then transported to a refinery for further purification. The two most common forms of refining are chemical and electrolysis. (DOVE is currently selling a chemical refinery but we have an electrolysis refinery in development.) A sample is then taken to a lab for tests or assays that measure the gold content. In most cases the gold is 99.9 percent pure.

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Melting:

Melting is the changing of gold from solid state to liquid state to it can be poured into molds such as gold bar molds where it will harden. Pure gold is generally too soft for most practical applications so other metals are nearly always added to it. When gold is combined in this way it forms an alloy. Scientists and goldsmiths often use colors to designate the various gold alloys that are possible. For example, white gold is made by combining gold with nickel, silver or palladium. Red or pink gold is an alloy of gold and copper. And blue gold is the result of mixing gold with iron. (DOVE currently is selling an LPG Gas Melting Furnace but has plans for an electrical induction melting furnace as well.)

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