

# Glossary

**Alumina**, or Aluminium Oxide (Al<sub>2</sub>O<sub>3</sub>), is the most important component of bauxite. Alumina has a high melting point, high compression strength, strong resistance to abrasion, and strong resistance to wide range of chemicals even at high temperature. About 90% of alumina is produced in the form of Smelter Grade Alumina for the use of aluminium metal production. The balances, Chemical Grade Alumina, are used in various applications such as in refractories, ceramics, polishing, electronic substrates, grinding media and abrasion resistant materials.

**Aluminium** (Al) is a silvery white, light weight, ductile and corrosion resistant metal. It is the most abundant metal in the Earth's crust, and the third most abundant element overall, after oxygen and silicon. Chemically too reactive to be found in nature as free metal, it is found in combined forms in over 270 different minerals. Aluminium is produced from smelter grade alumina, which is mainly processed from bauxite ore. Aluminium and its alloys are vital to the aerospace industry and other areas of transportation and building industries.

**Anthracite**. A hard and compact mineral coal that possesses the highest carbon content (92% to 98%). Containing the fewest impurities of all coals, Anthracite ignites with difficulty and burns with a short, clean, blue smokeless flame and delivers high energy per its weight. The principal use of anthracite today is for domestic fuel for stoves. It is prohibitively expensive for power plant use. Anthracite is used as one of the chemical reducing agents to produce ferronickel from nickel ore in Antam's ferronickel smelters.

**ASX**. Abbreviation of Australian Securities Exchange (formally known as the Australian Stock Exchange). Antam is listed on the ASX.

**Austenitic Stainless steel**. Austenitic or 300 series stainless steels comprise about 70% of total stainless steel production. They contain a maximum of 0.15% carbon, a minimum of 16% chromium and sufficient nickel to stabilize the austenite structure of iron. This austenitic crystal structure makes such steels non-magnetic and less brittle.

**Base Metals**. In the mining industry, base metals refer to industrial non-ferrous metals excluding precious metals. These include copper, aluminium, lead, nickel, tin and zinc.

**Bauxite** is the main source of ore for aluminium production. Bauxite contains 30-54% alumina (Al<sub>2</sub>O<sub>3</sub>) and a mixture of silica, various iron oxides, and titanium dioxide. It was named after the village where it was first discovered in 1821, Les Baux-de-Provence in southern France.

**Bayer Process** is the principal process of extracting alumina from bauxite. Bauxite is washed with a hot solution of sodium hydroxide (NaOH) at 175°C, to extract, dissolve and convert the alumina components to aluminium hydroxide (Al(OH)<sub>3</sub>). The other components do not dissolve and are filtered as solid impurities called red mud, which presents a disposal problem. The hydroxide solution is then cooled and the dissolved aluminium hydroxide precipitates out as a white, fluffy solid material. Through a calcination process, the aluminium hydroxide is heated at 1050°C to produce alumina and water vapor.

**BFS** stands for Bankable Feasibility Study. BFS will determine whether a project will be feasible enough to proceed and to obtain the needed financing. It usually consists of engineering, marketing, environmental, societal, and financial components.

**Blast Furnace**. Metallurgical furnace used for smelting ores to produce metals, generally iron. In a blast furnace, fuel and ore are continuously supplied through the top of the furnace, while air (sometimes with oxygen enrichment) is blown into the bottom of the chamber, so that the chemical reactions take place throughout the furnace as the material moves downward. The end products are molten metal and slag, which are tapped from the bottom, and gases that exit from the top of the furnace. The term has usually been limited to those used for smelting iron ore to produce pig iron, an intermediate material used in the production of commercial iron and steel.

**Calcine**. The materials produced by calcination process. Please refer to calcination below.

**Calcination (calcining)** is the thermal decomposition of a material. Examples include decomposition of hydrates such as aluminium hydroxide to aluminium oxide (alumina) and water vapor. It derives its name from its most common application, the decomposition of calcium carbonate (limestone) to calcium oxide (lime). The product of calcination is referred in general as "calcine," regardless of the actual minerals being treated. Calcination normally takes place at temperatures below the melting point of the product materials. Calcination processes are carried out in a variety of furnaces such as shaft furnaces and rotary kilns.

**CGA**. Chemical Grade Alumina represents about 10% of the alumina market and are mainly used in refractories, ceramics, polishing and abrasive applications. Please refer also to Alumina.

**Coke** is a solid but porous material produced and processed from low-ash, low-sulfur bituminous coal. The coal is baked in an airless oven at a very high temperature to eliminate the volatile and smoke producing components. Coke burns with little or no smoke and is a main fuel in pig iron-making blast furnaces.

**COW** stands for a **Contract of Work** between the Government of the Republic of Indonesia and a mining company established under a foreign investment scheme to provide long term regulatory business certainty to the company. The Contract of Work allows the company to conduct exploration, mining and production activities for an agreed upon time period and governs its rights and obligations relating to taxes, exchange controls, royalties, repatriation and other matters.

**CSR** stands for **Corporate Social Responsibility**, a concept whereby corporations ought to take responsibility for the impact of their activities on their stakeholders such as customers, suppliers, employees, communities, shareholders as well as the environment. Under the original concept, CSR activities are voluntary in nature. In Indonesia, however, CSR becomes obligatory and is recently stipulated under the Indonesian Company Law.

**Direct-reduced iron (DRI)** is produced from direct reduction of iron ore in solid state at 950 – 1050 °C by a reducing gas produced from natural gas or coal. Direct reduction is an alternative route of iron making for the steel industry. The specific investment and operating costs of direct reduction plants is low compared to integrated steel plants.

**Electric Arc Furnace (EAF)** is a furnace that heats charged material by means of an electric arc. In general, the physical and chemical process within the furnace is similar to the process mentioned in "blast furnace" entry previously. However, electric arc furnace is more efficient and is less damaging to the environment as compared to blast furnaces. EAF needs a stable source of electricity, which is usually supplied by a dedicated power plant.

**Electrolytic** reduction involves passing a large current of electricity through a molten metal oxide or an aqueous solution of the metal's salt to obtain the metal.

**EPC** stands for **Engineering, Procurement and Construction** contract. Under an EPC, the EPC contractor agrees to deliver a commissioned plant to the owner based on a mutually agreed upon scope and specifications, quality, project duration and investment cost. EPC is attractive to a project owner due to among things: 1) EPC gives the owner one point contact. It is easy to monitor and coordinate. 2) Investment cost, duration, specification and quality level is fixed and is known at the start of the project.

**Extractive metallurgy** is the practice of extracting metal from ore, purifying and recycling it. Extractive metallurgy phases involve mineral processing activities combined with hydrometallurgy and/or pyrometallurgy processes.

**FeNi** stands for Ferronickel. One of the main products of Antam, it is produced by processing high grade nickel ore through a pyrometallurgical technology. Antam's ferronickel consist of about 20% nickel and about 80% iron. Sold in the form of shots and pellets, either with high or low carbon content, Ferronickel is used as the feed materials for stainless steel production.

**Gold (Au).** Bright yellow, dense, soft, shiny, the most malleable and ductile of known metals and highly resistant to oxidative corrosion, gold is a highly sought-after precious metal which, for many centuries, has been used as money, a store of value and in jewelry. The metal occurs as nuggets or grains in rocks, underground "veins" and in alluvial deposits. Modern industrial uses include dentistry and electronics.

**GCG** stands for **Good Corporate Governance**. The managements of corporations that adhere to the principles of good corporate governance adhere to the principles of transparency, accountability, responsibility, independency and fairness in their operations and business dealings.

**Heap or Atmospheric Leach** is a branch within hydrometallurgical technology that is used primarily to treat oxide-rich nickel laterites with low enough clay contents, which allow acid infiltration. Ore size is reduced, mixed with clay-poor rock if necessary, and then stacked on impermeable plastic membranes. Acid is infiltrated over the heap, generally for 3 to 4 months, to liberate 60% to 70% of the nickel-cobalt content into acid solution. The solution is neutralized with limestone to produce a nickel-cobalt hydroxide intermediate product, which is then smelted for obtain refined metals. The plant and mine infrastructure are much cheaper - up to 25% of the cost of a HPAL plant - and less risky from a technological point of view. However, they are limited in the types of ore which can be treated.

**High Pressure Acid Leach (HPAL)** processing, a branch within hydrometallurgical technology, is required for nickel laterites where nickel is bound within clay or secondary silicate substrates in the ores. The nickel and cobalt metal is liberated from such minerals only at low pH and high temperatures, generally in excess of 250 degrees Celsius. HPAL plants could be used for most types of ore minerals, grades and nature of mineralization. However, it is highly capital intensive. While not as energy intensive as pyrometallurgy processing, it still require energy to heat the ore material. The heated acid has to be specially treated as they tear and wear down the plants and equipments.

**Hydrometallurgy** is a branch of extractive metallurgy which uses aqueous chemistry for the recovery of metals from ores, concentrates, and recycled or residual materials. Some of the hydrometallurgical processes include leaching, precipitation of insoluble compounds, pressure reduction.

**IDX.** Abbreviation of **Indonesian Stock Exchange**. In bahasa Indonesia, the abbreviation is BEI, which stands for Bursa Efek Indonesia. Antam is listed on the IDX.

**IRC** stands for **Indonesian Resources Company**, a holding company being envisioned by the government that will consist of PT Antam Tbk, PT Tambang BatuBara Bukit Asam (Persero) Tbk and PT Timah Tbk. There are also suggestions to include the government shareholding in PT Freeport Indonesia and PT Inalum. The merger is expected to provide various benefits such as increased earning quality from size and diversification, cost efficiency and greater access to capital. The IRC is still continuously being studied by the Government.

**ISO, International Organization for Standardization** (*Organisation internationale de normalisation*), is an international standard-setting body composed of representatives from various national standard organizations. Founded in 1947 and headquartered in Geneva, Switzerland, the organization promulgates world-wide industrial and commercial standards.

**JORC Code.**The Australasian **Joint Ore Reserves Committee** Code is one of the general standards accepted globally to govern the classification of mineral resources. Please refer also to mineral resources classification.

**KP** stands for the Indonesian word **Kuasa Pertambangan**. Literally means "Mining Authority", KP is basically the mining license issued by the government to corporations established under domestic investment scheme to conduct mining activities. Since 2001, in line with the country's decentralization drive, KPs are issued by the regional governments. The central government only issues KP for mining areas that overlap two or more provinces.

**Laterite.** The type of nickel deposits found in tropical area. It is one of the two types of nickel ore deposits, the other type being sulfide nickel sulfide ore deposit. Lateritic nickel ores are formed by intensive tropical weathering of the earth crust. Typical nickel laterite ore deposits are very large tonnage low-grade deposits located close to the surface. They comprise about 73% of the continental world nickel resources and in the future will be the dominant source for nickel production as the higher grade sulfide deposits are being depleted. Lateritic nickel ore consist of the lower grade limonite and the higher grade saprolite.

**LBMA** is the abbreviation of London Bullion Market Association. Although the physical market for gold and silver is distributed globally, most wholesale OTC trades are cleared and traded at the London Bullion Market by members of LBMA, most of which are major international banks, bullion dealers and refiners, and loosely overseen by the Bank of England. Five members of the LBMA meet twice daily to "fix" the gold price in a process known as the London Gold Fixing. The price is used as the benchmark for gold price worldwide. Antam's refined gold products are certified by LBMA.

**Limonite** nickel ore is low grade nickel laterite ore containing between 0.8% - 1.5% nickel, 25%-35% iron and a trace of cobalt. Limonite rests atop saprolite and is cheaper and easier to mine.

**LME.** London Metal Exchange is the world's premier non-ferrous metals market. It mainly offers futures and option contracts for aluminium, copper, nickel, tin, zinc and lead plus two regional aluminium alloy contracts. Although located in London, LME is a global market with international membership and with more than 95% of its business coming from overseas.

**Metal Tapping** is the operation of pouring off molten metals from the furnace. During smelting process, the molten metals are separated from slags or impurities. The slags, which float on top of the heavier molten metal, are tapped from the slag tap hole, which is located at the upper part of the furnace. Molten metals are tapped from metal tap hole, which is located at the lower part of the furnace.

**Mineral Processing, or mineral dressing,** is a phase within extractive metallurgy which usually is consisted of several activities such as particle size reduction through crushing and grinding, separation of particle sizes by screening, concentration by taking advantage of physical and surface chemical properties, and separation of solid component from liquid components of the particles through drying/dewatering. A number of auxiliary materials handling operations are also considered as mineral processing activities such as stocking, conveying, sampling, weighing, slurry and pneumatic transporting. Mineral processing is combined with hydrometallurgical and/or pyro-metallurgical processes as part of an extractive metallurgical operation.

**Mineral resource classification** is the systematic organization of information on ores and other mineral deposits which may contain economic value. The specific economic categories of mineralization are: 1) prospects which are of geological interest but may not be of economic interest 2) **mineral resources**, include those which are potentially economically and technically feasible, and those which are not 3) **ore reserves**, must be economically and technically feasible to extract. The common terminology for mining, "ore deposit", must have an 'ore reserve', and may or may not have additional 'resources'.

**NCPI** stands for **Nickel Contained in Pig Iron**, a product of recent developments in low grade nickel ores (limonite) processing. Nickel limonite, due to its 25% to 35% iron content, is essentially similar to low-grade iron. Certain steel smelters in China have developed a process for blending nickel limonite ore with conventional iron ore to produce NCPI (containing 2-4% nickel) as stainless steel feed products. This process short-circuits the capital intensive hydrometallurgical route for producing nickel from low grade nickel ore, which is then used in stainless steel anyway. Operational cost of NCPI production is high, however. NCPI production may not be economical when nickel prices fall in the future.

**Nickel (Ni)** is a silvery white metal that is hard yet malleable, versatile, inert to oxidation and able to retain its properties under extreme temperatures. About 65%-70% of nickel is consumed for the production of stainless steel, while the rest is used for various industrial purposes such as batteries, electronics, aerospace applications and land based gas turbines.

**Open-pit mining**, also known as **opencast mining** or **open-cut mining**, refers to a method of extracting minerals from the earth when the valuable deposits of minerals are found near the surface ie. where the overburden (surface material covering the valuable deposit) is thin or the material of interest is structurally unsuitable for tunneling.

**Ore** is a volume of rock containing minerals that is rendered to be valuable to be mined. Ore is an economic entity, not a physical entity. Fluctuations in commodity prices, the costs of extraction, the grade of the mineral within the ore, etc., will determine what rock is considered valuable and hence ore, and what rock is not valuable and is considered waste.

**Oxidation and Reduction.** Most metals occur in nature in their oxidized form and must be reduced to their metallic forms. Metal oxides are smelted by heating with coke or anthracite (forms of carbon), a reducing agent that liberates the oxygen as carbon dioxide leaving a refined mineral. The chemical term for the conversion of carbon to carbon dioxide is oxidation. Meanwhile the conversion of metal oxides to refined metal is called reduction.

**Pig iron** is produced by smelting iron ore with coke and resin. Containing very high carbon content, pig iron is very brittle and is considered as an intermediate product. The traditional shapes of these ingots appear like a litter of piglets suckling on a sow, hence the name pig iron. Pig iron is intended for re-melting and for further processing to produce commercial iron and steel.

**Precious metal** is a rare metallic chemical element of high economic value. Precious metals are less reactive chemically than most elements, have high luster, more ductile and have higher melting points than other metals. Precious metals were important as currency, but are now regarded mainly as investment and industrial commodities. The best-known precious metals are gold and silver. Other precious metals include the platinum group metals: ruthenium, rhodium, palladium, osmium, iridium and platinum. Rhenium is a precious metal that is not part of the platinum group or one of the traditional precious metals.

**Pyrometallurgy.** A branch of extractive metallurgy that consists of treatments of ores and concentrates at high temperature by transforming the physical and chemical nature of the materials to recover the valuable metals. Pyrometallurgical process generally consists of: Drying, Calcining, Roasting, Smelting and Refining. Pyrometallurgical is energy intensive in order to sustain the temperature at which the process takes place. The energy is usually provided in the form of fossil fuel combustion or from electric energy as well as the sustained heat from the molten materials themselves.

**Reserves and Resources.** Please refer to mineral resource classification.

**Risk Capital** refers to the investments undertaken by mining companies in exploration programs. Exploration is risky since there is no guarantee that the investments spent on exploration will result in findings of ore deposits.

**Saprolite.** Saprolite nickel ore is formed beneath the limonite zone. It contains generally 1.5-2.5% nickel and is considered high-grade nickel laterite ore. Using a pyrometallurgical process, saprolite is used as the raw materials for the production of ferronickel.

**SGA. Smelter Grade Alumina** or metallurgical grade alumina is the alumina utilised in the manufacture of aluminium metal. SGA comprises 90% of the alumina market.

**Silver (Ag).** A soft, bright white, lustrous metal that has long been valued as precious metal used to make ornaments, jewellery, high-value tableware and utensils and currency coins. It has the highest electrical conductivity of any element and the highest thermal conductivity of any metal. It occurs as a pure free metal and alloyed with gold, as well as in various minerals. Most silver is produced as a by-product of gold, coppers, lead and zinc mining.

**Slag** is the by-product of smelting ore to produce metals. They may contain a mixture of metal oxides, metal sulfides and metal atoms in elemental form. While slags are sometimes considered as waste in metal smelting, they also serve other purposes, such as in assisting smelt temperature control and minimizing re-oxidation of the final liquid metal product.

**Smelting** is a process within pyrometallurgy technology of extracting a metal from its ore. It usually takes place in a furnace at a temperature above the melting point of the metal and uses a chemical reducing agent, commonly a fuel that is a source of carbon such as coke or anthracite, to liberate the oxygen as carbon dioxide or carbon monoxide and to produce the refined metal. Without the proper reducing agent, heated metal ore will only produce molten ore. As most ores are impure, it is often necessary to use "flux", such as limestones or borax, to remove the impurities as slag.

**Refining** is the removal of further impurities from metals that have been smelted. This covers a wide range of processes, involving different kinds of pyrometallurgical "fire refining" using furnaces as well as through certain electrolytic processes.

**Sponge iron** is the product created when iron ore is reduced to metallic iron, usually with some kind of carbon at temperatures below the melting point of iron. This results in a spongy mass, sometimes called a bloom, consisting of a mix of incandescent wrought iron and slag. Sponge iron is not useful in itself but must be processed to create wrought iron (commercially pure iron).

**SPLC.** Smart Predictive Line Controller stabilizes the arc of an electric furnace by dynamically controlling a series reactor installed between the Utility and the Electric Furnace. The controlled reactor acts as a dynamic spring to stabilize the arc. SPLC could be the solution to maintain the high temperature of Antam's furnaces should we decide to convert the source of our power plants' fuel from the more expensive but more stable and efficient diesel to the less expensive but less efficient and less stable coal.

**Stainless steel** is defined as an iron-carbon alloy with a minimum of 11.5% chromium content. Stainless steel's resistance to corrosion and stain, low maintenance, relatively inexpensive, and familiar luster make it an ideal base material for a host of commercial applications. There are over 150 grades of stainless steel. However, the most popular - 70% of the stainless production - is in the form 300 series austenitic stainless steel which contains high content of nickel. Stainless steel production consumes 65%-70% of nickel production.

**Tailings**, also known as slimes, tailings pile, tails, leach residue, or slickens, are the materials left over after the process of separating the valuable components from the worthless components of an ore. Tailings represent external costs of mining. As mining techniques and the price of minerals improve, it is not unusual for tailings to be reprocessed using new methods, or more thoroughly with old methods, to recover additional minerals.

**Underground mining.** A method of extracting minerals that require tunneling into the earth because the minerals occur deep below the surface (thick overburden) or they occur as veins in hard rock.

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