

### ***Lime production***

*Lime* is an astringent material obtained by firing and subsequent processing of limestone, chalk and other calcareous-magnesian rocks. Pure lime is a colorless product, poorly soluble in water (about 0.1% at 20 °C), with a density of 3.4 g / cm<sup>3</sup>.

Lime was used mainly for the preparation of binding solutions in the construction of buildings. Over time, its application has expanded, and now it and substances based on it are used in many industries, agriculture, and even in environmental protection.

In the metallurgical industry, lime allows the metal to be purified from phosphorus, sulfur, or silicon impurities that are formed when oxygen is introduced into molten iron or steel.

Such an introduction to the production process takes place in three stages:

- firstly, for the production of pellets (semi-finished products of iron that are loaded into the smelter);

- secondly, they purify the material from sulfur before melting;

- thirdly, after oxygen is mixed with the fused material, lime in a solid or crushed state is added to the furnace to form hard slags that can be easily removed at this stage.

Such use makes the steel ultra-pure: it is in this form that it is most appreciated in the market.

Lime is also actively used for the production of metal products: in the creation of wire or shaped elements, it is indispensable as a kind of "lubricant". In the first case, the wire without problems extends through the matrix, and the finished product easily departs from the form sprinkled with "chalk".

The use of quicklime in the production of colormet has also been mastered: the smelting of precious metals is not complete without it. It is known that gold and silver ore are ground at a certain stage, mixed with a solution of cyanide and lime. The latter provides the necessary acid balance, which prevents the evaporation of harmful substances into the atmosphere.

No less well-known to us copper or lead are also produced not without the participation of this universal material. The harm from dangerous fumes is reduced when they are passed through the so-called "lime milk".

Raw materials for the production of *air lime* are calcareous-magnesian carbonate rocks (limestones, chalk, dolomitized limestones, dolomites, etc.).

The composition of limestone includes calcium carbonate ( $CaCO_3$ ) and a small amount of various impurities (clay, quartz sand, dolomite, pyrite, gypsum, etc.). Theoretically, the calcium carbonate is composed of 56%  $CaO$  and 44%  $CO_2$ . It occurs as two crystalline minerals-calcite and aragonite. When heated to a temperature of 300-400°C, aragonite turns into calcite, crumbling into a powder.

In dolomitic limestones, dolomite  $CaCO_3 \cdot MgCO_3$  is present as an impurity. Theoretically, it consists of 54.27%  $CaCO_3$  and 45.73%  $MgCO_3$ , or 30.41%  $CaO$ , 21.87%  $MgO$ , and 47.72%  $CO_2$ . Dolomite rocks contain dolomite and clay, sand, glandular and other impurities.

Typically, clean and dense limestones are fired at temperatures up to 1,100-1,250°C. The more carbonate rock contains impurities of dolomite, clay, sand, etc., the lower the optimum calcination temperature (900–1,150°C) to obtain softly burnt lime. Such lime is well quenched with water and gives a dough with high plastic properties.

The best quality lime is obtained from rocks in which impurities are present in the form of uniformly distributed particles up to 1 μm in size. Impurities of gypsum are undesirable, with their content in lime even about 0.5-1%, the plasticity of the lime test is greatly reduced. Iron impurities (especially pyrite) significantly affect the properties of lime, which even at temperatures of 1,200°C and more cause the formation of fusible eutectics during firing, which contribute to the intensive growth of large crystals of calcium oxide, slowly reacting with water during quenching and causing phenomena associated with the concept of "burnout".

*The main operations for the production of lump quicklime:* extraction and preparation of limestone, preparation of fuel and calcination of limestone.

Before firing, limestone is suitably prepared: sorted by size of pieces and crushed.