

ors of light pink, blue and purple found in Oriental gems are sometimes noticed in small crystals.

Bauxite is the purest naturally-occurring amorphous oxide of aluminium known. This mineral was originally found at Baux, France, from which it derives its name, but purer forms are now obtainable on this continent. The best quality only is used in the manufacture of alundum, and in its preparation practically all impurities are removed. The high grades of bauxite used are of rare occurrence. The Norton Company, however, owns its own mines from which the purest grade is obtained.

The bauxite is heated in calciners to drive off the combined water, and is then melted directly in electric furnaces of special design. It was not practical to fuse bauxite commercially until the invention of this process. The temperature in these furnaces probably ranges from 5,000 degrees to 6,000 degrees Fahrenheit.

The operation of these furnaces and the composition of the molten bath is under the control of the furnace operative. Exact quality and uniformity, which are so important in steel manufacture, are fully as important in the manufacture of alundum. The highest grades of steel are now being made in electric furnaces because impurities can be removed at the high temperatures obtained by the electric arc, and the quality of the molten bath uniformly maintained. In the alundum furnace both the purity and uniformity of the alundum are assured. Each step in the process is under the close supervision of expert chemists, who are constantly directing and following the work by careful analyses in the Norton Company's chemical laboratory.

After the ingots of alundum have cooled they are broken up and the pieces are then reduced to smaller pieces by means of powerful crushers. After this reduction the material is still further reduced by being passed through smaller crushers and several sets of grains, which are required in the manufacture of grinding wheels. After passing through rolls, it is subjected to the usual washing and drying processes to prepare it for manufacture into grinding wheels, rubbing and sharpening stones and other articles.

The solid massive alundum, while resembling the purest natural corundum in chemical composition, has the remarkable quality of being considerably harder than the natural product. This is due to the perfectly fluid condition in which the mass is brought, the control of its composition, the rate and method of its cooling and solidifying by which it receives its temper, and the absence of water of combination.

The necessary requisites for the most efficient abrasive for grinding wheels are: 1st, sharpness; 2nd, hardness; 3rd, right temper; 4th, uniformity.

In order to insure rapid and continued cutting so far as sharpness is concerned, a peculiar quality is necessary. There must be a fracture which will give a number of sharp cutting points.

In the matter of hardness the recognized standard is the diamond, which is the No. 10 in the scale of hardness; nothing that man has yet discovered or made equals the diamond in hardness. The term "hardness" is, therefore, a comparative term, the hardness of a mineral being ascertained by its ability to scratch another mineral of a known degree of hardness, or to be scratched by such a mineral.

Pure crystalline corundum, represented by the best sapphire or ruby, has always been the standard for No.

9 in the scale of hardness. This is readily scratched by alundum; in fact, alundum powder is used for cutting and drilling rubies and sapphires for watch jewels, etc.

By "temper" is meant its strength of grain and the character of its fracture under grinding pressures. An alundum grain is remarkably tough and will stand more crushing pressure before breaking than any other abrasive grain, but when it does break it breaks with a sharp crisp fracture, giving a fresh, keen cutting edge. This is a most important quality in an abrasive.

Purity, besides resulting in greater hardness and better temper, is necessary in the bonding of the grain into wheels in order to secure accurate and uniform results. Uniformity is necessary to secure constant efficiency of grade and temper in a wheel, so that wheels can be accurately duplicated at any time and maintain their standard of work.

Uniformity is one of the most important requisites in an abrasive. The ability to duplicate grinding wheels is essential to obtain the best results. In grinding wheels the abrasive grain of a given size is bonded together to produce a certain grade or temper for a certain kind of work. The term grade, as applied to wheels to designate the degree of hardness, is the resistance of the particles to the pressure employed in the act of grinding. A wheel from which the particles are easily broken is called soft, while one which retains its particles longer is called hard. Wheels are graded from soft to hard, depending upon the class of work on which they are used. Different grades of wheels are obtained, according to the amount of bond employed, the wheel becoming harder as the amount of bond used increases.

Different grades are required for different materials to be ground; cast iron, steel, brass, glass, bone, leather, wood and other substances demand wheels of special grade, which must be duplicated to make the grinding operation continuously efficient.

Then a record of each wheel is entered on a prepared form, with description on wheel, number of revolutions, order number, and for whom the wheel is intended. This record is signed and sworn to by the tester of the wheels each day before a Justice of the Peace, and carefully filed by the Norton Company. A record is preserved of each order, so that it can be duplicated exactly as to composition, cutting quality, shape and size.

Very few people realize the many uses for which grinding wheels are employed. They are used in the machine shop for sharpening all kinds of tools, cutters, reamers, taps, dies, etc. In the foundry for grinding castings. The sawyer gums and files his saws with an alundum wheel with no danger from drawing the temper of the tool. The leather manufacturer finishes the leather for suede gloves on a grinding wheel. The manufacturing optician grinds the edges of lenses for eye glasses. In the great glass works beading, fluting, edge grinding of tumblers, checkering fine stars, and fine work of all character calls for grinding wheels and abrasive stones.

The Canadian Fairbanks Company, Limited, are the selling agents for Norton grinding wheels, and stones, and carry large stocks in their several warehouses at Montreal, Toronto, St. John, Winnipeg, Calgary and Vancouver. Catalogues and booklets describing the manufacturing of alundum into grinding wheels will be mailed to any address on application.