

Volodymyr I. Shamray, PhD. student,
Valentin V. Korobyichuk, candidate of science, docent,
Svitlana K. Kobzar, language advisor,
Zhytomyr State Technological University

ANALYSIS OF FACTORS THAT AFFECT THE POLISHING OF NATURAL FACING STONES

There are many ways and tools for natural stone polishing. These tools are quite diverse: flikers with different granularity, abrasive cutters, elastic wheels, felt wheels, abrasive sticks and polymer-based polishing wheels. Various chemical powders and pastes are also used for facing stone polishing. Among all existing methods of stone polishing, the most common type is the process with the use of polishing machines with flikers of different granularity. It ensures high quality indicators of natural stone polishing without the use of auxiliary powders and pastes.

In determining the quality of natural stone polishing, first of all, great attention must be paid to the polishing characteristics of polished stones, measured by two main parameters: reflectivity after polishing and the time required for one surface unit polishing, namely labour coefficient. The ability to take in the mirror polishing is not connected with physical and mechanical properties of stones and entirely depends on their petrographic features. Every type of stone is characterized by marginal luster, and after reaching this level of luster, the polishing quality does not change. The marginal luster of a group of granites is determined by mineralogical composition of rocks in which the dominant role belongs to quartz and feldspar. Decorative kinds of quartz, quartzite, pegmatite and petrified wood are those which can be polished in a proper way. Rocks that cannot be polished are mainly the stones with big granular structure and beady texture, which include minerals that cannot be polished (clay, oxides of iron, ore minerals, aluminosilicates and similar to them). The degree of decorative stones polishing can be estimated by reflectivity after polishing and classified into four types: I – excellent (86–100 %), II – good (71–85 %), III – average (36–70 %), IV – bad (<36 %) (tabl. 1).

Table 1

Classification of stone reflectivity after polishing

Category for reflectivity (GOST 9479-84)	Types of stone	Reflectivity after polishing	
		In % of standard	In relative terms to the standard
I (excellent)	Marble: Koelhinskyy (standard), Ufaliyskyy, Hazhanskyy;	86–100	170–200
II (good)	Marble: Ruskealskyy, Pushtulimskyy; Travertine: Shahtinskyy, Vedynskyy; Quartzite: Shokshynskyy; Granites: Yantsivskyy, Zhezhelivskyy, Korostyshiv, Tokivskyy, Emilyanivskyy, Bohuslav, Novodanylivskiy, Kapustynskyy, Kudashivskyy; Gabbro: Slipchytiskiy, Golovinskiy, Rikotske; Labradorite: Golovinskiy	71–85	140–170
III (average)	Conglomerates: Knorinhskyy, Kuibyshevskyy, Slate: Nihozerskyy; Granites: Kornynskyy, Hromadskyy; Basalts: Parakarskyy, Norskyy, Rivnenskyy	36–70	70–140
IV (bad)		<36	<70

Table 2 shows the classification of facing stones according to the time they take to be polished. As the table shows, the most easily and quickly polished are fully crystalline marbles, which are followed by marble limestones and granite, and then basalt.

Table 2

Classification of stone polishing

Group	Types of stone	Ratio of workability
I	Granites: Zhezhelivskyy, Kornynskyy, Bohuslav, Novodanylivskiy, Kudashivskyy; Gabbro: Slipchytiskiy, Golovinskiy	4,0
II	Granites: Yantsivskyy, Korostyshivskyy, Tokivskyy, Emilyanivskyy, Kapustynskyy; Gabbro: Rikotske; Marble: Pushtulimskyy; Slate: Nihozerskyy; Quartzite: Shokshynskyy	2,3
III	Marble: Koelhinskyy (standard), Ufaliyskyy, Hazhanskyy; Travertine: Shahtinskyy, Vedynskyy	1,0

Each mineral has certain properties that are different and, accordingly, have different susceptibility to the grinding and polishing process and acquire different surface luster. For example, granite consists of the minerals such as feldspar and quartz, and their physical and mechanical properties are different.

The differences in the hardness of feldspar (6,5 by Mohs) and quartz (7 by Mohs) are insignificant, but they can affect the quality of polishing – sometimes scarcements of quartz are observed on the polished surface. The quality of polishing is also affected by anthropogenic fracturing, which worsens the possibility or even makes it impossible to obtain a mirror surface. These stones are commonly used for production of flat surface articles. Natural fissures of brown quartz, granite and pegmatite are made by iron hydroxide, or sometimes partially by mica in pegmatite. The first ones form slightly visible reddish “threads” on the polished surface, which have no effect on the quality of texture pattern. But fissures filled with mica worsen the quality of polishing. In the samples in the areas where they are found, you can sometimes see shallow and thin grooves left after falling of mica scales.

The value of the ratio of reflected light to the point of absorption determines the luster of the stone: the higher the amount of reflected light is, the brighter the luster is. Light absorption is the energy loss of the light wave that overcomes through a substance, owing to the conversion of wave energy into various types of internal energy of the substance or energy of secondary emission of light of other direction and spectral composition. Previously, in the Basic Law of Light Absorption by Bouguer-Lambert-Beer, it was shown that the ability to absorb light primarily depends on the nature and concentration of the substance. Light absorption is determined by absorption coefficient and it depends on the wavelength, the chemical nature and condition of the substance. It shows how the light intensity decreases in e times ($e = 2,718$).

Thus, having analyzed the factors that affect the quality of polishing we can come to the conclusion that the key to all the factors that affect the quality of the polished surface is petrological features of a decorative stone, which explain the genesis, mineralogical composition and its structure. Due to it, using photogrammetric analysis, we can determine the coefficients of absorption and reflection of light that characterize the luster of the stone, and is a main quality indicator of stone polishing.