

# The Application of Zibo Clay in Ceramics

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## Foreword

The fundamental function of artistic glaze lies in its visual attraction and pleasure. Artistic glaze can manifest such function to the maximum. When people appreciate and evaluate ceramic works, the results vary according to the geographic region, culture and education background and aesthetic quality. Besides its shape, there is usually an aesthetic standard by which people can reach an agreement. In fact, bearing the understanding on the essence of beauty in minds, people can find their favorite forms of beauty. Such varying aesthetic standards lay a social foundation for the popularity and development of artistic glaze in turn.

## The Application of Zibo Clay in the Ceramics

There have been four kinds of prominent glazes since the Song Dynasty. 'Lan Jun' Glaze and 'Rabbit Fur' Glaze are two of these. These two kind of glazes fall into the category of black glaze. Black glaze was invented in the late Eastern Han Dynasty (220 AD). In the Sui Dynasty and the Tang Dynasty witnessed a significant development of black glaze. And in the Song Dynasty (960–1279AD) such black glaze techniques is relatively mature. As the glaze's colour is as black as lacquer, so it is named black glazed porcelain.



the Eastern Han Dynasty (25AD)



the Eastern Jin Dynasty (317AD)



the Tang Dynasty (618AD)



the Five Dynasties (907AD)



the Song Dynasty (960AD)



the Qing Dynasty (1644AD)

In the Song Dynasty, black glaze in Zibo had evolved from black glaze to artistic glaze. Series of black glaze, such as 'Lan Jun' Glaze, 'Rabbit Fur' Glaze and other artistic glaze were developed.



'Rabbit Fur' Glaze



'Lan Jun' Glaze

Zibo has abundant yellow clay resource. When it is used as glaze material, after a long period of exploration and practice people that different thickness of such glaze affect the colour of the work surface. Thin glaze turns into brown colour, and thick glaze makes pure black colour. Due to its medical effect, yellow clay is also called medicine soil by local people.



medicine soil (Glaze)

After the local government advocated for recovery 'Lan Jun' Glaze, 'Rabbit Fur' Glaze, Mr. Liu Kaimin, from Shandong Silicon & Ceramic New Material Technology Co. Ltd, has dedicated so much for the successful revival of 'Lan Jun' Glaze and 'Rabbit Fur' Glaze, which once disappeared in the early 1950s. 'Lan Jun' Glaze and 'Rabbit Fur' Glaze flourished again. The significance is far-reaching.



'Rabbit Fur' Glaze



'Lan Jun' Glaze

### **The Application of Yellow Clay in 'Lan Jun' Glaze, 'Rabbit Fur' Glaze**

The yellow clay contains some trace elements, such as  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{CaO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$ ,  $\text{FeO}$ ,  $\text{MnO}$ ,  $\text{TiO}_2$ ,  $\text{P}_2\text{O}_5$ , etc. When the content of  $\text{Fe}_2\text{O}_3$  is lower than 5%, the work surface will become brown after firing; when the content of  $\text{Fe}_2\text{O}_3$  is no less than 8%, the work surface appear to be pure black. The glaze demonstrates high viscosity and stabilization at the firing temperature of 850°C. Some additive agents are added to ensure the glaze matching with firing temperature for the work and the coefficient of expansion of the work. The firing temperature is 1310°C.

#### **Its Formula:**

##### 1. Ground Coating Glaze

The ground coating glaze is made of yellow clay and additive agents. The yellow clay should be soaked in the water for 24~48 hours, and then screened through mesh size of 150. The content of additive agent should be 11% of the dry yellow clay.

The ingredients of the additive agents:

Barite(barium sulfate)	$\text{BaSO}_4$	5%
K-feldspar	$\text{K}_2\text{O}\cdot\text{Al}_2\text{O}_3\cdot 6\text{SiO}_2$	23%
Iron oxide	$\text{Fe}_2\text{O}_3$	10%
Calcium carbonate(limestone)	$\text{CaCO}_3$	22%
Stalactite	$\text{CaCO}_3$	5%
Calcareous marl(containing many trace elements)		2%

Mixing water with the ingredients in the proportion of one to one, 10 kg. Loading the mixture of the materials into the mill, grinding the materials for 24 hours, passing through 200-mesh screen, and the screen residue is 0.5~1%.

Add these ingredients to the yellow clay and mix all materials well.

## 2. Formula of 'Lan Jun' Glaze

K-feldspar	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	30%
Stalactite	$CaCO_3$	14%
Zinc oxide	$ZnO$	4%
Titanium oxide	$TiO_2$	9.5%
Aluminum fluoride	$Al_2F_6$	4%
Quartz	$SiO_2$	26%
Raw Datong Soil		8%



Cooked talc  $Mg_3(Si_4O_{10})(OH)_2$  4%

Barium carbonate  $BaCO_3$  10%

Sodium silicate(water glass)  $NaSiO_3 \cdot 9M_2O_2$  0.15%

Mixing water with the ingredients in the proportion of one to one, 10 kg. Loading the mixture of the materials into the mill, grinding the materials for 12 hours, passing through 200-mesh screen, and the screen residue is 0.5~1%.

The firing temperature is 1310°C.

## 3. Ingredients for 'Rabbit Fur' Glaze

K-feldspar (16-mesh)  $K_2O \cdot Al_2O_3 \cdot 6SiO_2$  40%

Quartz (16-mesh)  $SiO_2$  22%

Stalactite (16-mesh)  $CaCO_3$  16%

Raw Datong Soil (16-mesh)

5%

Tin oxide  $SnO$  5%

Zinc oxide  $ZnO$  17%

Sodium silicate(water glass)  $Na_2SiO_3 \cdot 9H_2O$  0.08%

Mixing water with the ingredients in the proportion of one to one, 10 kg. Loading the mixture of the materials into the mill, grinding the materials for 12 hours, passing through 200-mesh screen, and the screen residue is 0.5~1%.

The firing temperature is 1310°C.

## 4. Method for Applying the Glaze

Methods for applying the 'Lan Jun' glaze, 'Rabbit Fur' glaze are basically the same. At first, the underground coating glaze is applied, the thickness is 1~1.5mm. Once the surface is dry to the touch, the covering glaze is applied respectively. The covering glaze thickness is 1mm.

The application of covering glaze should not exceed two-thirds of surface area of the work. Due to low viscosity and high mobility of the 'Lan Jun' Glaze, 'Rabbit Fur' Glaze, the artifacts which is applied with the same composition of glaze would appear unexpected results at high firing temperature of 1310°C and the very glaze colour is quite different. This is what the changes in the kiln firing process can hardly replicate two identical artifacts means.

Zibo clay had deep impact on the development of Zibo black glaze Series (Artistic Glaze). Its content accounts for 89% of the basic glaze formula, from which other artistic glaze are derived, such as 'Partridge Specks' Glaze and 'Reed' Artistic Glaze. Such efforts foster and promote the development of Zibo artistic glaze.