Research on the New Woodleaf Glaze in Celadon

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Abstract: Since the emergence of celadon, there have been thousands of years of history. The glaze of celadon is also diversified by a single, and there is a lot of geographical features of the kiln. The innovation of glaze has an important influence on the development of celadon. The main research of this paper is a rich wood-leaf glaze. At first, this kind of wood-leaf glaze can only be applied to the black jizhou kiln porcelain. The material is generally mulberry leaf directly attached to the surface of the green body after being processed and fired. After the porcelain is formed, the composition of the leaf is golden and has a high ornamental effect[2]. Because of the uncertainty of the blade itself during the firing process, the success rate of firing is very low, and the yield cannot be predicted at all. In this project, a kind of glaze that resembles metal glaze with golden color, simple color and no obvious luster is prepared by researching and analyzing the chemical composition of mulberry leaf.This type of glaze can greatly reduce the problem of high lead content in metal glazes. The wood glazes studied in this topic are fired at high temperatures and can be applied not only to celadon decoration but also to various daily-use ceramics and the decoration[1].

1 INTRODUCTION

It is a fusion of natural with nature, and the production of wood-leaf cup is entirely a result of the wisdom of nature and the ancients. There have been more than 1,200 years of baking history since then, of which black glaze porcelain was the most representative. Because of the uncertainty of the leaves in the firing process, each samovar will have a different shape, and the yield is very low, and the wood-leaf cup have been loved by the public. Then, after the burning of the wood-leaf cup, people continuously carried out research experiments to complete the re-burning of wood-leaf cup[3]. The golden leaf color of the wood-leaf cup is consistent with the contemporary rustic style. This study prepared a wood leaf glaze with golden wood leaf color by analyzing the composition of the wood leaf glaze and firing experiments[4]. The traditional wood-leaf cup is only shown by the black undercoat. This study will use traditional celadon as the experimental object[5]. By controlling the content of iron and rare metals in the glaze, the wood-leaf glaze can be incorporated into the celadon to make it more vivid and beauty. The research results of the project can be widely applied to more porcelain decorations, and can also be used as a glaze with metallic color. The wood leaf glaze is burned at a high temperature and is different from the low lead glaze containing high lead content. Glazes need to be fired at high temperatures, so they are lead-free and non-toxic and can be widely used in the processing of daily-use ceramics. The research has a high research value and has huge market potential

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2 EXPERIMENTAL STEPS AND CONCLUSIONS

The color of the glaze needs to be matched with the use of high iron content mud, which helps the hair color of the leaves. The thickness of the glaze layer is about 0.5-0.8mm, and it is fired in an oxidizing atmosphere. The firing temperature is about 1250-1300℃. Too high a temperature is not good for the emergence of the of leaves color. The electric kiln is in full compliance with its firing standards, so it is possible to abandon the traditional firewood kiln and gas kiln. The electric kiln is easy to operate, easy to operate, the heating curve and atmosphere are relatively stable, and the finished product rate is high.

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2.1 The Data Collection

The wood leaf glaze is prepared by replacing the chemical components in the mulberry leaf with mineral chemical substances. The data of Table 1 can be obtained by examining the chemical composition of the glazed glaze minerals in the wood leaf aphid product at different temperatures:

Table 1: The energy spectrum analysis of the glaze surface after decorative wood leaves.

T/°C CE	800	950	1050	1150	1200	1250
SiO_2	35.88	42.7	49.30	57.93	58.10	58.35
P_2O_3	6.29	5.80	4.51	2.72	2.62	2.54
Fe_2O_3	0.32	0.49	1.00	2.49	3.76	4.64
Al_2O_3	2.69	3.78	7.58	10.86	13.35	15.46
Cr_2O_3	1.95	1.61	1.08	0.74	0.66	0.58
MnO	0.84	0.72	0.69	0.68	0.63	0.59
MgO	4.98	3.20	3.01	2.74	2.39	2.28
CaO	35.20	30.01	22.17	15.58	11.87	10.11
K_2O	9.97	8.89	7.37	6.01	4.39	4.26

According to studies, we can choose the specific gravity of raw materials at 800℃ to calculate the specific gravity of each component of the wood leaf glaze. Calculation of wood-leaf glaze type. Through the energy spectrum analysis of the wood leaf glaze in Table 1, the wood leaf glaze type can be calculated. a. Calculate the number of constants for each chemical formula in the glaze. The analytical values of each component are divided by their corresponding molecular weights to obtain their respective quotients. Each quotient is divided by S (the sum of basic component quotients to be added) to calculate that each component is in glaze type Constant number. (Table 2). b. According to the calculated number of constants, the wooden leaf glaze type is listed. (figure 1)

Table 2: Reference Values (Values Rounded):

Name	Assay value	Molecular weight	Quotient	Base element	S	The constant number
SiO_2	35.88	60.1	0.597			0.69
P_2O_3	6.29	142.3	0.04			0.05
Fe_2O_3	0.32	159.7	0.002			0.002
Al_2O_3	2.69	102	0.03			0.03
Cr_2O_3	1.95	294.2	0.01			0.01
MnO	0.84	70.9	0.01	0.01	0.87	0.01
MgO	4.98	40.3	0.12	0.12		0.14
CaO	35.20	56.1	0.63	0.63		0.72
K_2O	9.97	94	0.11	0.11		0.126

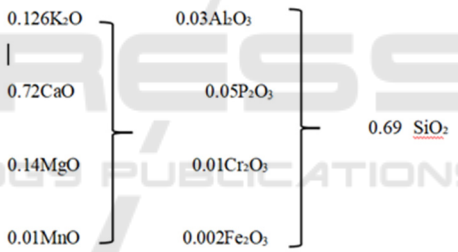

Figure 1: wood - leaf glaze type.

Calculate the weight percentage of each ingredient in the recipe. a. According to the glaze data format of Figure.1, the weight percentage of raw materials used for preparing the wood leaf glaze was calculated. In view of the cost, all oxides cannot be used in glazes, and there are many sources of raw materials for the same chemical composition. In order to replace glaze, a suitable compound is used instead of oxides, for example, Al2O3 is replaced by orthoclase (Al2O3·6SiO2). Since ortho-feldspar contains elements such as K, Al, and Si, the use of K2O, Al2O3, and SiO2 can be reduced during glazing. After determining the raw materials, use the constant number in Figure 1 to equalize the number of constants for each raw material, as shown in Table 3.Multiplicity of each constant and each molecular weight to obtain the blend amount of each raw material. b. Calculate the weight percentage of raw materials by the sum of the blended amounts.

Table 3: Reference Values (Values Rounded).

Name	Constant number	Chemical Formula (Alternative)	Constant number	Molecular weight	Harmony	Weight (%)
SiO_2	0.69	SiO_2	0.51	60.1	30.651	21
P_2O_3	0.05	$CaO{\cdot}P_2O_5$	0.05	310.3	15.515	11
Fe_2O_3	0.002	$Fe{+}O_3$	0.002	159.7	0.3194	0.2
Al_2O_3	0.03	$K_2O{\cdot}Al_2O_3{\cdot}6SiO_2$	0.03	556	16.68	12
Cr_2O_3	0.01	$K_2Cr_2O_7$	0.01	294.2	2.942	2
MnO	0.01	MnO	0.01	70.9	0.709	0.5
MgO	0.14	$MgCO_3$	0.14	84.3	11.802	8
CaO	0.72	$CaCO_3$	0.57	100	57	40
K_2O	0.126	K_2O	0.086	94	8.084	5.6

2.2 Ball Grinding Glaze and Test Strip Test

The grammage of each raw material was precisely weighed, and the ingredients and water were put into a ball mill for ball milling according to the specific gravity of 1:0.7. The balls in the ball mill tank must not exceed one-half of the tank solvent. The ball milling time is about 30 minutes to ensure that the ball mill particles can pass through a 120 mesh screen. The longer the ball-grinding time, the finer the glaze. But, if excessive ball mill, the glaze material is easy to crack when the glaze is dry, it easy to produce shrinkage glaze, jump glaze and so on.

Combine with celadon's mud glaze to make no less than 6 sets of test pieces, respectively placed in different directions of the upper and middle three floors of the kiln in order to observe whether the glaze color has the stability and best firing position. The thickness of the glaze of each test piece must be thin and thick. Only the upper half of the test piece is glazed, which can facilitate observation of the color and flow of glazes of different thicknesses. Each test piece must be etched with different depths of scribes using tools to observe the effects of different layers of glaze.

2.3 The Effect of Temperature on Yield

Kiln: electric kiln, Test pieces: 6 sets of 6 pieces
The kiln temperature 1100℃, 1150℃, 1200℃, 1250℃Cand 1300℃

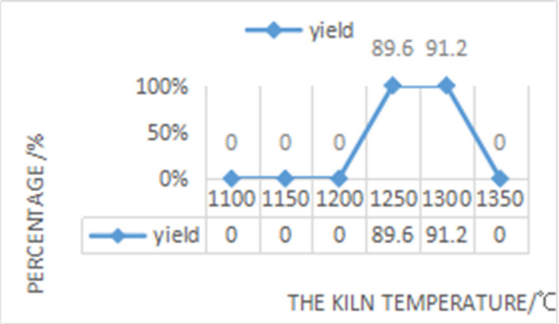

Figure 2：influence of kiln temperature on yield

2.4 The Effect of Temperature on Yield

Glaze processing temperature: 850℃and 1250℃. Sample: 200g low temperature metal glaze, 200g wood leaf glaze is melted into powder.
a (pre-low temperature metal glaze of lead)
b (low-temperature metal glaze after lead analysis)
c (before lead wood leaf glaze)
d (wood leaf glaze after lead analysis)

Equipment: ball mill, scanning electron microscope (produced by philips of the Netherlands), energy spectrometer (produced by idax, USA). Accelerate precipitation lead placement environment: temperature 70℃, relative humidity 75%

Table 3: comparison of lead quantity of low temperature metal glazes.

Name	Pb
a	67.6
b	73.1

Table 3: comparison of lead quantity of low temperature metal glazes.

Name	Pb
c	0
d	0

3 CONCLUSIONS

By analyzing the experimental data, the best firing temperature of the wood leaf glaze is between 1250-1300℃.The color rendering effect of the wood leaf glaze in the celadon test piece is compared with that of the traditional wood leaf figurine. The color stability of the wood leaf glaze has been significantly improved, and it is not necessary to treat the chlorophyll in the leaf blade with a reagent, which is convenient to use and has a high success rate. The new wooden leaf glaze course was decorated with ceramic paintings to enhance the controllability of the decoration. The wood leaf glaze studied in this paper can be fired at high temperature to ensure that no lead element is harmful to the user's health. It can be clearly seen from Table 4 that the glaze a prior to the lead expulsion contains high lead itself, and the lead content becomes higher after the treatment. Compared with the low-temperature metal glaze, the cost of the wood leaf glaze is low, and the use range is large, and the high cost of multiple reburning can be saved by burning at a high temperature once. This study has achieved new breakthroughs in both food safety and decorative effects.

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