The Data-base program analysis with the gradation of colour development in glaze by added cobalt blue stain

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1. Introduction

Nowadays is called as "the age of information". For a lot of information such as the composition of glaze of data and building cyber spaces, the relationship between information has been required to use computer simulation.

Above all, the D/B system is necessary for simulation. In the pottery fields, glaze material is known as having a large number of variables[1-2]. By developing computer simulation for the stain glaze which has many variable, it is possible to investigate the colour development of stain. The diversity of colour development in pottery glaze is studied as a function of the atmosphere, temperature and composition[3]. The purpose of our study is to develope the D/B system[4] of the glaze experiment.

2. Experimental procedure

Figure 1. shows D-base of colour development, and then its optimized condition and full range were investigated. The composition of lime glaze were chosen as base glaze, which has wide fusion ranges at high temperature. Clear glaze and matt glaze were manufactured and then stain effect on the colour development, stain additives and base glaze composition[3] was studied.

Whiteware body specimen (40×40×8㎜) which has the composition of Hadong Kaolin 25%, Kimchun Quarts 15%, China Clay 19.5%, Unsan Pottery 19.5%, Kyoungju Pottery 21% was prepared in order to investigate the effect of stain additives and base glaze on fusion state. The specimens were dried and biscuit fired. The composition of base glaze was that of Lime glaze by Seger equation. Its raw materials with different compositions were mixed in the ultrasonic mill and grinded after drying. In the process of colour development of oxide stain, material were weighted by CoO : $Al(OH)_3$ = 35 : 65(wt%) for having stable spinel structure at high temperature. The powders were milled in plastic jar and dried in oven. The powder was calcined at 1250℃ for 2hr[5]. These specimens, base glaze, and additive stain were weighted as 20 g as the variation of additive content of 0.5, 1, 5, 10, 15(wt%). Those are again were mixed in ultrasonic milling and glazed by means of dipping. We gave temperature gradient and examined the effects.

3. Gradation of colouring in the stain

Although the use of data base has been developed these days, the research on pottery glaze is not studied thoroughly since the mechanism of colour development in stain depend on the various factor such as chemical potential, excited valence electron, irregular valence bonding, etc.. As well as, the colour development of inorganic oxide comparing with organic oxide is not analyzed easily[5-6]. Stains of spinel is known to be stable at high temperature[7-8]. It is fabricated by combining the material having spinel structure with gradation of colouring oxide[9-14]. Figure 2 shows that crystal phases of powder was spinel structure though XRD after calcination. It is thought that the spinel composition of $CoAl_2O_4$ is obtained. Colour development investigated by using the stain of cobalt blue system which had wide fusion range and stable colour development.[8,12-14]

And when additive stain is added more than 5wt%, the difference of colour is not clear. Thus, it is considered that the optimum composition is less than 5wt% of stain.

4. Establishing the database of result by experiment

Experimental conditions and data are scanned and program chart are plotted for computer simulative programming[4,15-17]. Figure 3 shows flow chart of data which was made according to Clear glaze and Matt glaze as well as the temperature of 1150, 1250, 1350℃. The data of compositions and Seger equation of binary system concerning above conditions is inputted for D/B operation. The classification of input is buttonized to understand the entire conditions easily, which basically make it easy to extract data using mouse clicking when data is opened in figure 4.

As shown Figure 5 in the colouring of Lime base glaze which has a wide range of fusion temperature the colour development of cobalt-blue at 1250℃ is better than those at 1150, 1350℃. The ratio of Al_2O_3 to SiO_2 is in the range from 1:4 to 1:8 was set in the binary system of Al_2O_3-SiO_2 and the composition of the clear and matt glaze were determined to be 1:8 and 1:4, respectively, so the entire soft fusing of matt glaze was shown in Figure 6. The stable colour development of cobalt-blue system was found in the system which has a relatively high ratio of RO/R_2O, namely less R_2O_3 was more preferable. The high resolution of colour development was not perfectly carried out in the process of D-basing these data.

According to additive ratio and temperature coincided with anticipated result as shown in figure 5, 6. So it is possible to develope the D/B of data of the colour formation in other stains. The research concerning the wide range of colour development and the thermal properties of material are needed to find the possibility of simulating data using computer on classic ceramics.

5. Conclusion

In the colouring of Lime base glaze, the colour development of cobalt-blue at 1250℃ is better than those at 1150, 1350℃. And the variation of colour development was not found when additive content of glaze is more than 5 wt.%.

The stable colour development of cobalt-blue system was found in the system which has a relatively high ratio of RO/R_2O. The high resolution of colour development was not perfectly carried out in the process of D-basing these data.

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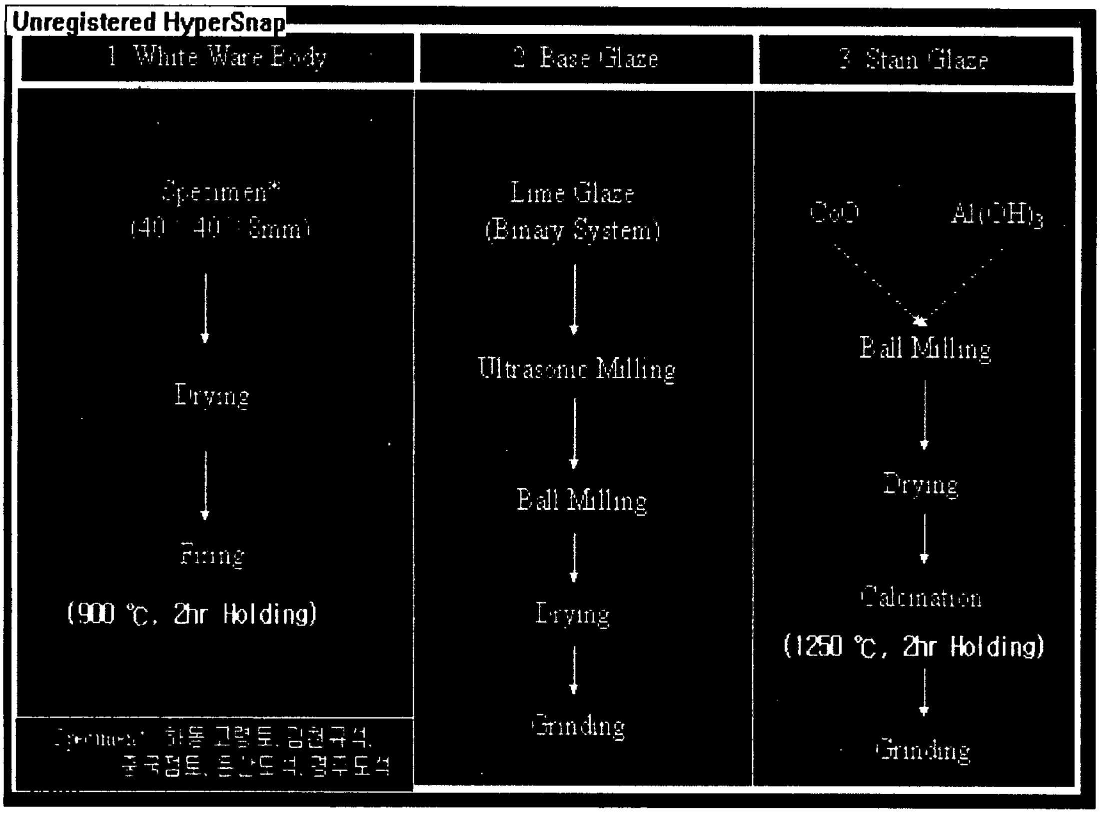

Fig 1. Experimental Procedure of whiteware body, base glaze and stain glaze.

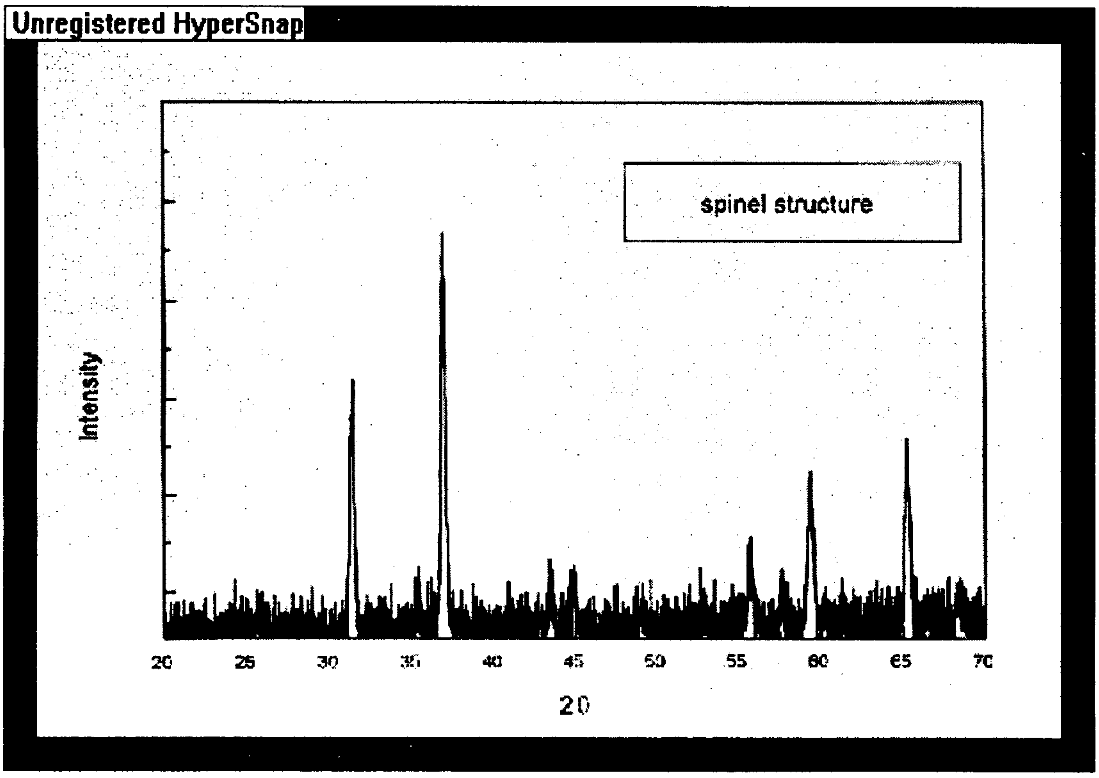

Fig 2. X-ray Diffraction pattern of calcined CoO: $Al(OH)_3$ Stain.

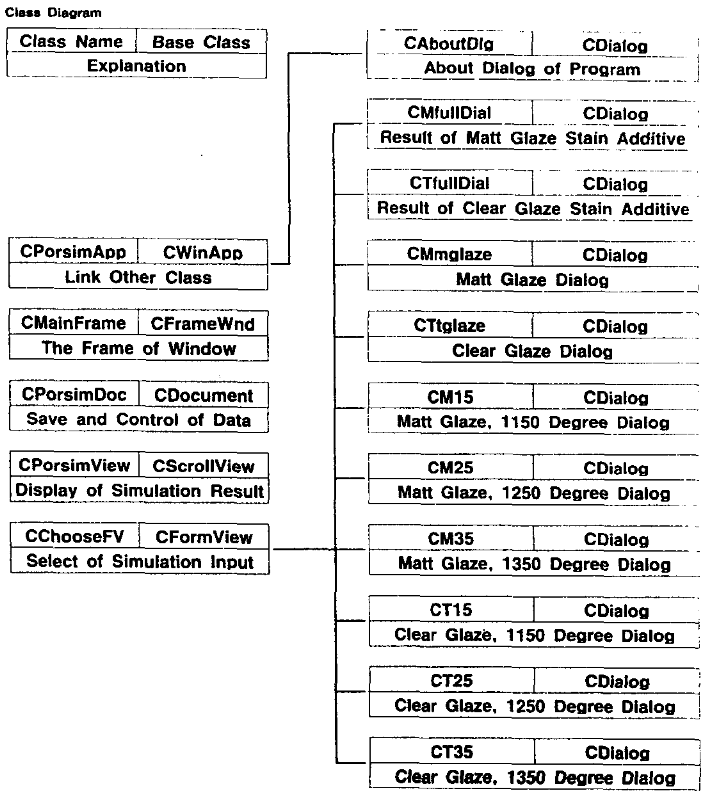

Fig 3. Class diagram by classification of temperature, base glaze and stain.

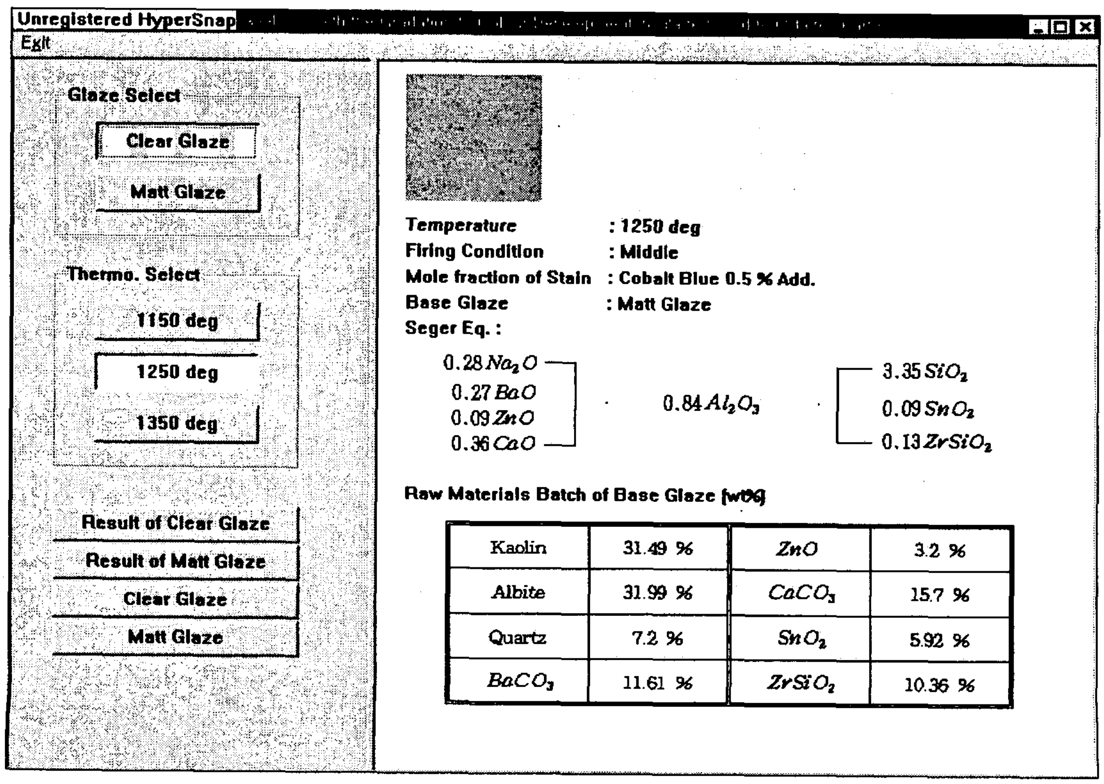

Fig 4. D/B program of Clear glaze 1150 deg select.

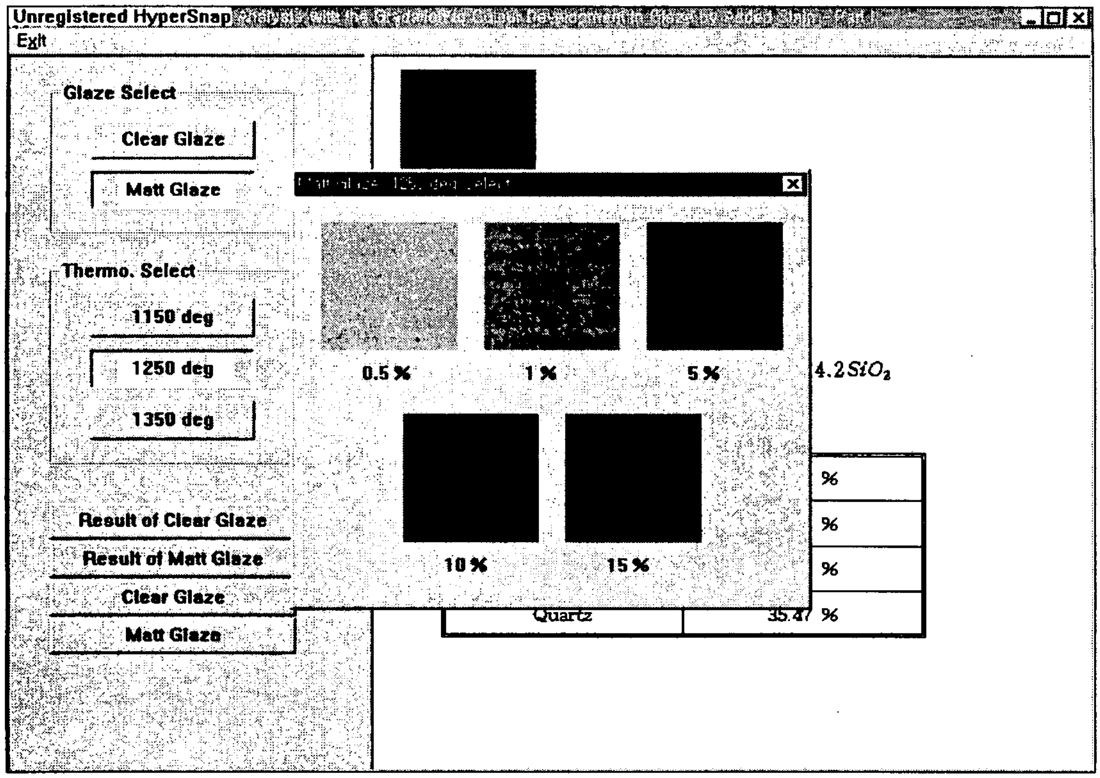

Fig 5. D/B program of Mat Glaze, 1250deg select in full mode.

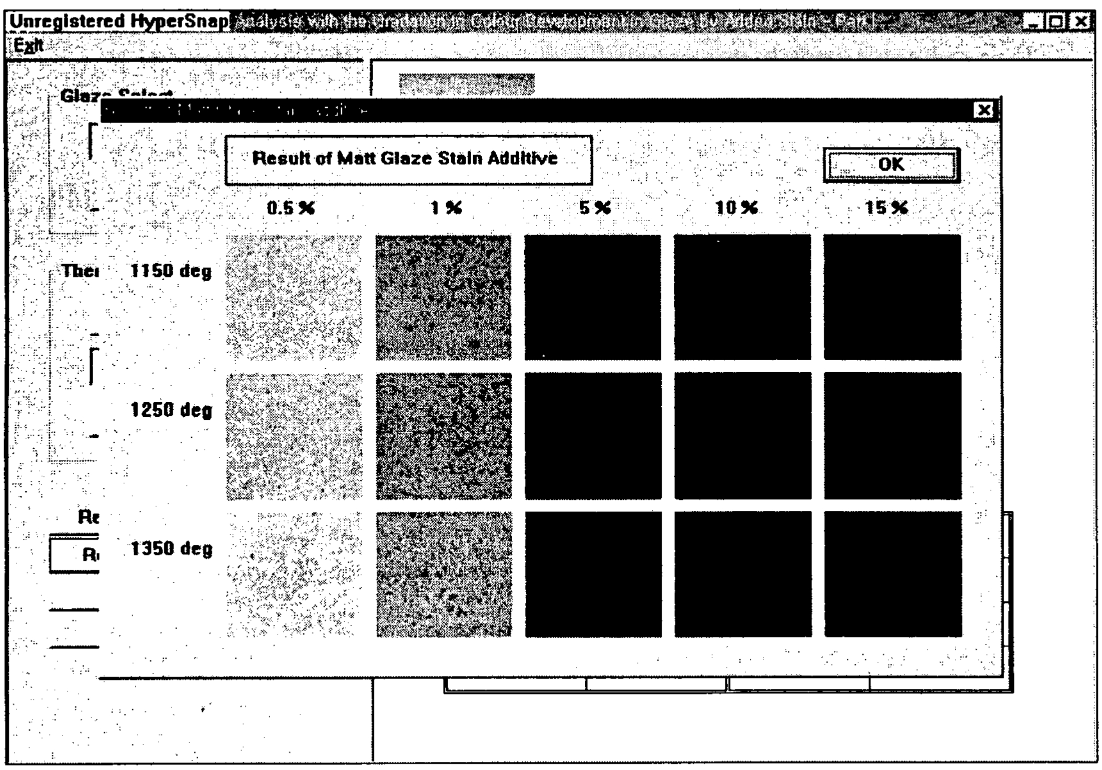

Fig 6. D/B program of Clear glaze by stain additive in full mode.