opción

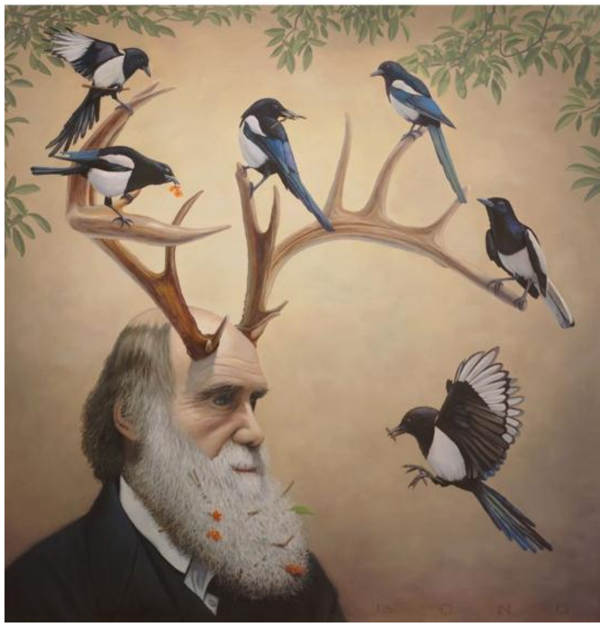
Revista de Antropología, Ciencias de la Comunicación y de la Información, Filosofía, Lingüística y Semiótica, Problemas del Desarrollo, la Ciencia y la Tecnología

Año 35, 2019, Especial N° 22

Revista de Ciencias Humanas y Sociales

ISSN 1012-1587/ ISSNe: 2477-9385

Depósito Legal pp 198402ZU45



Universidad del Zulia

Facultad Experimental de Ciencias

Departamento de Ciencias Humanas

Maracaibo - Venezuela

Opcion, Año 35, Especial Nº 22 (2019):*2899-2921*
ISSN 1012-1587/ISSNe: 2477-9385

Effect Misfire Density of colored Oxides (SnO2 , CoO) In Glaze

Samer Ahmed-Hamza; Haider Sabah Albakry; Monther Mohamed Soliman

Abstract

In this research a glass mixture is formulated from a group of acidic, basal and neutral compounds according to specific weight ratios to produce a glass that matures at low temperature to be applied to the surface of the clay body. Colored ceramic glass using black cobalt oxide (CoO) at a constant rate of (1%) With the addition of tin oxide with different weight ratios of (1 - 8%) with glass mixture and within the composition to study the effect of this opaque oxide in the nature of surface, color and tangible results of the ceramic body, the burning is done using an electric oven and the temperature (920 m) and maturity time (One hour). Where the cobalt oxide works on the coloring of the glass mass to be a colored base through which shows the effect of dark oxide ((SnO2) and invest the difference in the coefficient of density and surface tension and the melting point between the cobalt oxide and tin oxide to create liquid darkness within the layer of glass through the property (phase - phase The effect of this characteristic was clearly graded by different ratios. 1- 1-2% did not give clear results due to the melting action of cobalt oxide. 2 - (3 - 4%) color became less intense with the appearance of small color spots on the surface. 3- (5-6%) the appearance of color spots on the surface in large sizes. 4- The percentage of (7 - 8%) clear spread of color spots due to the difference of density and tensile strength with reduced effect of colored oxide

Densidad de falla de efecto de óxidos coloreados (SnO2, CoO) en el esmalte

Resumen
En esta investigación, una mezcla de vidrio se formula a partir de un grupo de compuestos ácidos, basales y neutros de acuerdo con proporciones de peso específicas para producir un vidrio que madura a baja temperatura para aplicarse a la superficie del cuerpo de arcilla. Vidrio cerámico coloreado con óxido de cobalto negro (CoO) a una tasa constante de (1%) Con la adición de óxido de estaño con diferentes proporciones en peso de (1 - 8%) con mezcla de vidrio y dentro de la composición para estudiar el efecto de este opaco óxido en la naturaleza de la superficie, el color y los resultados tangibles del cuerpo de cerámica, la combustión se realiza utilizando un horno eléctrico y la temperatura (920 m) y el tiempo de maduración (una hora). Donde el óxido de cobalto trabaja en la coloración de la masa de vidrio para ser una base coloreada a través de la cual se muestra el efecto del óxido oscuro ((SnO2) e invertir la diferencia en el coeficiente de densidad y tensión superficial y el punto de fusión entre el óxido de cobalto y óxido de estaño para crear oscuridad líquida dentro de la capa de vidrio a través de la propiedad (fase - fase El efecto de esta característica fue claramente calificado por diferentes proporciones. 1- 1-2% no dio resultados claros debido a la acción de fusión del óxido de cobalto. 2 - (3 - 4%) el color se volvió menos intenso con la aparición de pequeñas manchas de color en la superficie. 3- (5-6%) la aparición de manchas de color en la superficie en tamaños grandes. 4- El porcentaje de (7 - 8%) extensión clara de manchas de color debido a la diferencia de densidad y resistencia a la tracción con efecto reducido de óxido de color.

1. Theory of the atomic pattern of ceramic glass (structural formula)

Glaze glass is scientifically classified as a composition that falls between the liquid and solid states, so it can be considered a fourth state of matter, of course, in addition to the gaseous state, so it is called (vitreous state), an amorphous and random state, or Automatic atomic distribution, more precisely (amorphous), this group represents the structures of glass and glaze (Badri, 2002, p. 41)

Glazed compositions are not characterized by a precise and inevitable molecular formula, but are a complex mixture belonging to the liquid state being random atomic distribution, and solid state that the final product is a mechanical solid composition, and therefore is sometimes called super cool liquid, and the glaze mixture consists of a group of compounds Natural atoms whose elements are characterized by independent coherence, to form specific molecules or crystalline network, depends on how to mix with specific weights and proportions and known, and after exposure to a temperature consistent with the properties of these compounds begins the process of disintegration and fusion (Fusion), and the atoms become swimming in one environment is not isolated from each other, And with raising the heat At the beginning of the formation of the liquid face (Surface of Liquid), each atom rearranges its position and bonded again according to the law of equivalence, and when cooled quickly notice the formation of continuous random chains, some of which are physically characterized by the properties of the oxides and compounds already composed, and others according to the properties of new chains Al-Badri, 2002, pp. 41--42)

Zachariasen's theory of 1938 was the first theory to clarify the atomic structure of glass, and was reinforced by a later study by Warren, and also in 1938, by investing in X.RD tests that provided a clear visualization of the structure of porcelain glass. This theory, called silicon oxide (SiO_2), was the main scientific unit in explaining and interpreting the atomic structure of glass and glazing, and is still (Naseef, 1983, p). : 8)
Understanding the structural composition of ceramics for ceramics is "an introduction to understanding the nature of glazing and its basic properties of surface and color tissue structure, mechanical properties and resistance, and its relationship to temperature." (Naseef, 1983, p: 8)
2.3 Reaction effect of ceramic glass components

One of the first priorities of glass chemistry is that porcelain glass is based on the synthesis of three oxide groups. Acid, modifier of physical and chemical properties in porcelain glass grids, and finally neutral oxides with two behavior, acid and base in their reaction (Amphoteric Oxides), characterized by their interaction as an intermediate balance (Henrik & James, 1993, p: 17) (Al-Badri, 2002, pp. 44-45). .

Scientific standards are used to distinguish between these oxidation groups, in terms of the size of their positive ions and the nature of their charges and the strength of the bond between those positive ions and oxygen ions, in addition to the nature of the electronic and surrounding groups, acid oxides are characterized by an acoustic strength between the positive and negative one. It is estimated at 440 KJ mol-1, that is, kilojoules / mol, and for basic oxides up to 150 KJ mol-1, and below, while the two (neutral) reactions are between 440-450 KJ mol-1. (Naseef, 1983, p: 8)

The factors that contribute to determining the nature of the reaction and state of each ion within the glass grid and glazing are the size of the ion (Ionic Radius), the potential voltage (Ionic Potential), and the electronic distribution around its positive nucleus, when a particular element has a small ion size, and a potential high voltage, It is characterized by its ability to attract oxygen (O2) more strongly than others, (Henrik & James, 1993, p: 19), and this characterizes the nature of competition between positive ions to obtain a certain negative ocean when the glaze melts and the reaction of its compounds, which means that the increase in size The ion weakens the strength and speed of its interaction and attracts oxygen and thus the formation of porcelain glass grids For example, this means that the number of its negative ions and the size of the largest therefore, for example, we find that the silicon ion (Si) of the size (0.4) It is surrounded by four (4) oxygen ions, and boron (B) is the size (0.2), and surrounded by three (3) Oxygen ions, Ca (Ca) and Na (Na) are (0.99) in size and are surrounded by six (6) oxygen ions (Al-Badri, 2003, p. 45).

There are some ions with the ability to exist in both quadrilateral and hexagonal states. For some components of the ceramic glass grille, it was found that the ionic strength is higher for the acid and neutral oxide ions, while it is lower for the base oxides (Naseef, 1983, p: 14).

s	The Oxide	Ionic	Ionic Radius	Field Strength	Electro Negativity	Dissociation Energy	Single Bond KJ/mole
1.	Si_2O	Si^{+4}	0.42	22.67	1.8	1774.01	443.50
2.	B_2O_3	B^{+3}	0.23	56.71	2.0	1464.4	497.89
3.	Al_2O_3	Al^{+3}	0.51	11.53	1.5	1681.9	442.58
4.	V_2O_5	V^{+5}	0.59	14.36	1.6	1878.6	376.468
5.	CaO	Ca^{+2}	0.99	2.04	1.0	1075.2	133.88
6.	MgO	Mg^{+2}	0.66	4.59	1.2	928.84	154.84
7.	BaO	Ba^{+2}	1.34	1.11	0.9	1087.84	138.07
8.	Na_2O	Na^{+1}	0.97	1.06	0.9	502.08	83.68
9.	Li_2O	Li^{+1}	0.68	2.16	1.0	602.49	150.62
10.	K_2O	Ka^{+1}	1.33	0.56	0.8	481.16	54.39

Table (2.1), Characteristics of Some Glass Grid Components (Naseef, 1983, p: 14)

2-4 Eutectic Point

Scientific sources defined the otectic point as “a mixture of the appropriate amount of active ingredients in the structure of the glass lattice, and at the right temperature, all enter the reaction to form the liquid glass after dissolution” (Auther, 1994, p: 111).

When exposed to these materials, the appropriate temperature will begin the process of disintegration and fusion, and become atoms of the compound swimming in one medium and not isolated from each other, note that half of the size of the ion (Ionic Radius) and potential voltage (Ionic Potential) or (potential potential for gravity VA) and distribution The electron around its positive nucleus are the factors that determine the nature of the reaction and the state of each ion within the glass grille, since the ability of the oxides that make porcelain glass to enter easily in the reaction, depends on the internal strength of the atom (Inter Atom Force) (Alkradi, 2012, p. 30), (Hindawi, 1997, p. 12), and the compounds that make the ceramic glass Dissociation Energy, to be ready to enter the reaction, by overcoming the potential energy attracted in its atoms, freeing and entering the reaction (the establishment of glass grids), and to reach the full interaction, which is known as the point of otectic (Rahaman, 2012, p: 191)
High temperatures will lead to the gradual melting of glass compounds, depending on the behavior and degree of melting of each oxide, but that behavior varies in that the compounds are individually, when combined, (Athur, 1994, p: 112), since the otectic is a condition The harmony and convergence of materials in one burning condition and the atmosphere of a single chemical reaction, and scientists have examined them by proposing a triple reaction (Ternary), and a binary reaction (Budworth, 1970, p: 95). The silica (SiO_2) melting temperature is in the range of (1710o C), while the alumina (Al_2O_3) is fused within the temperature range (2050o C), as for For example, magnesium oxide (MgO) is melted to about 2800oC, but all this will change in a formula imposed by the new reaction of these compounds after their meeting, different from theoretical predictions, according to information taken from the nature of each substance Preparation of the glass mixture, although different temperatures and varying chemical and physical properties, the results come differently, which is represented by finding a suitable temperature for all of them and the entry of the reaction, and this is what is known in the technology of ceramic (Eutectic Point), the point of entry of materials In a thermal reaction, to form a vis-

cous liquid Agi as a complex, interlocking and overlapping system, and Campain in Fig. 2-1, the Binary Interaction is a proposed two-material formula, to examine their interaction together, and to determine the critical temperature of the otectics of both (Henrik & James, 1993, p: 22) (Philippe & Jean, 2007, p: 14)

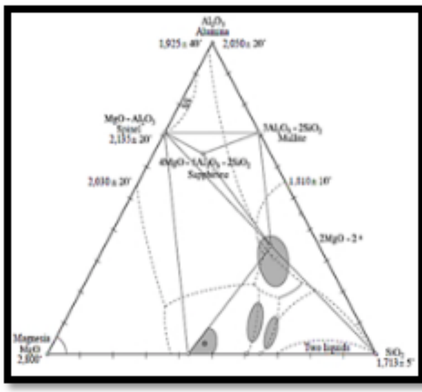


Figure (2-1), The Iutectic System (Philippe & Jean, 2007, p: 14)

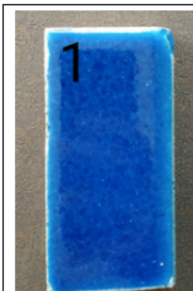
The angular heads of the triangle represent the main materials forming the structure of the grille in the glass of the porcelain, called (the main peaks), the components involved in the formation of the glass mixture proposed by the potter. X-ray diffraction (X.RD), as an analytical technique, gives information about the structure, chemical composition, and physical properties of materials. Are electromagnetic rays y T energy, in the field of eV) (100 to (K eV100), leading to the identification Aloaotktek process point (Eutectic Point). (Robert, 2010, p: 102)

practical part

In this research, a glass mixture is formulated from a group of acidic, basal and neutral compounds according to specific weight ratios to produce a glass matured at low temperature to be applied to the surface of the clay body. Tin oxide with variable weight ratios (1 - 8%) with glass mixture and within the composition to study the effect of this dark oxide and the effect of the difference of density value between these oxides in the nature of surface, color and tangible results of the ceramic body

(1) Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	38
Dolomite	$CaCO_3.MgCO_3$	10
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	20
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	1

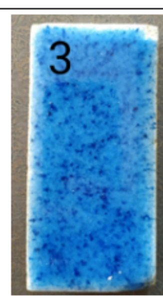


(2)Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	37
Dolomite	$CaCO_3.MgCO_3$	9
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	22
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	8
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	2

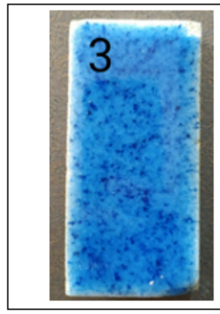
(3)Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	35
Dolomite	$CaCO_3.MgCO_3$	8
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	23
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	3



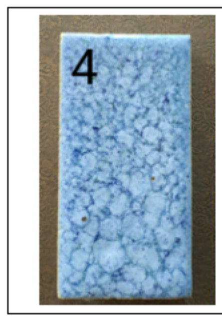
(3)Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	35
Dolomite	$CaCO_3.MgCO_3$	8
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	23
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	3



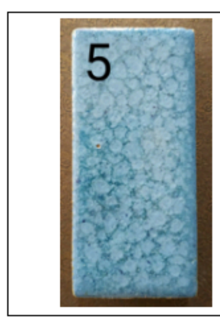
(4)Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	33
Dolomite	$CaCO_3.MgCO_3$	8
Sodium Carbonate	Na_2CO_3	9
Lead Oxide red	Pb_3O_4	25
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	4



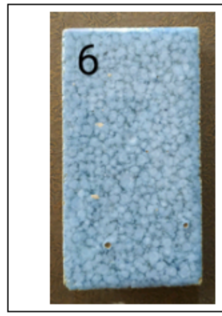
(5) Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	34
Dolomite	$CaCO_3.MgCO_3$	8
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	25
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	8
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	5



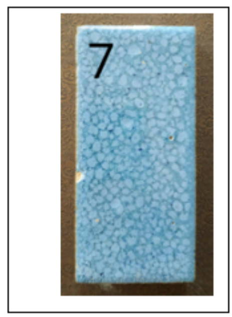
(6) Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	33
Dolomite	$CaCO_3.MgCO_3$	8
Sodium Carbonate	Na_2CO_3	9
Lead Oxide red	Pb_3O_4	23
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	6



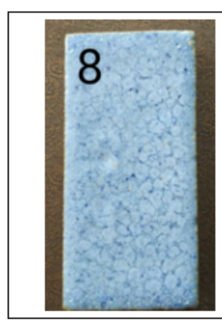
(7) Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	39
Dolomite	$CaCO_3.MgCO_3$	4
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	29
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	7



(8) Glass Blend

Name	Formula	%
Feldspar Potash	$K_2O.Al_2O_3.6SiO_2$	33
Dolomite	$CaCO_3.MgCO_3$	5
Sodium Carbonate	Na_2CO_3	10
Lead Oxide red	Pb_3O_4	23
C.C	$Al_2O_3.2SiO_2.2H_2O$	10
Flint	SiO_2	10
Cobalt Oxide	CoO	1
Tin Oxide	SnO_2	8



Burning at a temperature of (1100 Co) and a time of 15 hours and without a period of maturity or extra time (sooging Tim) A number of tests were performed on ceramic models
Color value testing device
Texture checking device
Digital microscope examination
16. Calculation of the density coefficient
The density of glass is the total density of its oxides, and the density of porcelain glass ranges between (8.120 - 2.125 g / cm3).
Percentage of oxide
Density = -------------------- × constant oxide density
100

Oxide	Fixed density
SiO_2	2.7
Al_2O_3	3.8
Na_2O	2.5
Pb_3O_4	9.1
$CaCO_3.MgCO_3$	2.8
$K_2O.Al_2O_3.6SIO_2$	2.5
B_2O_3	1.8
FeO	5.7
CuO	6.4
CoO	5.7
Cr_2O_3	5.2
NiO	6.7
MnO	5.3

. Discussion of the table of oxide structures:
The addition of colored oxide compositions to the transparent glass mix-

ture is carried out in percentages of weight, ie (1%) of copper oxide means 1) g per 100 g) transparent alkali glass, and what determines the percentage of oxide addition is the coloring strength of these oxides through information Available and previous experience in the use of these colored oxides.
. Discuss the results of density and melting point:
The intensity is related to the physical phenomena of light, through which optical disturbances occur in terms of refraction and reflection. , And the difference in density may lead to different phases within the glass layer, which leads to the occurrence of one of the types of opacity, which is the opacity of the liquid or what is called opacity (liquid - liquid).
The density of porcelain glass ranges between (2.125-8.120) g / cm3, and through the constant density and percentage of oxide, according to the formula for finding the density of oxides, it was found that the density of transparent alkali glass is (2.76), that the addition of colored oxides to transparent glass leads It turns into a shiny tinted glass taking into account that the addition of colored oxides leads to increased glass density, which increases the value of refractive index and light reflection from the surface. In the present research, two types of oxides are added in the glass mixture. This requires studying the behavior of these oxides in terms of density in the glass layer. Its density ranges from 5.2 to 6.7, while the opaque oxide (SnO_2) has a density of 6.8, so tin oxide is the highest among all colored and opaque oxides. (1-3%), with coloring oxides, did not change the origin of colors of these oxides with alkali glass but helped to give chromatic stability on the surface with g As the tin oxide remains in the form of granules or impurities stuck in the glass layer for dark events, these grains will be colored with a colored glass fuse.

Another factor is the degree of melting of the added oxides, and by reference to the melting table of oxides we find that tin oxide (SnO_2), is the lowest of all oxides of color and dark as it melts (1150 m) o, and this makes the tin oxide is the closest to the fusion and interaction with Glass components generate a higher-density colored glass block inside the glass layer surrounded by a colored medium with oxide compositions.This leads to a perimeter colored according to the composition of the oxides with white dots of different density and melting point.The diagram shows the effect of increasing the percentages of coloring oxides on density values.

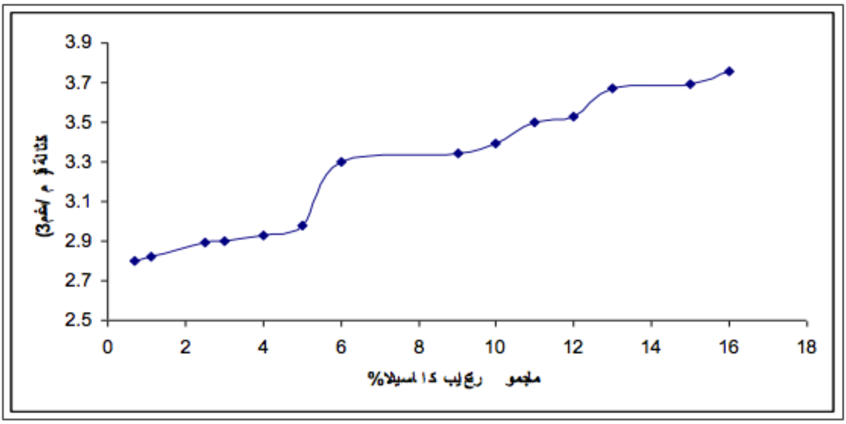


Chart (1-4) shows the effect of percentage oxide addition percentages on density values

References

. Al-Badri, Ali Haider: Scientific Techniques of Ceramic Art (Clay), Vol. 1, 1st Floor, Yarmouk University, Amman - Jordan, 2000.
2. Al-Badri, Ali Haider: Scientific Techniques of Ceramic Art (Glazing), Vol. 2, 1st Floor, Yarmouk University, Amman - Jordan, 2002.
3. Goldsmith, Abdul Hadi Yahya and Khalid Mahmoud Nabat: Mineralogy, Ministry of Higher Education and Scientific Research, University of Baghdad, b.
4. Al-Maamouri, Mohammad Hamza: Non-destructive Testing of Engineering Materials, 1st Floor, Ministry of Higher Education and Scientific Research, Babylon University, 2012.
5. Samer Ibrahim: Physical Optics, Dar Al Safa, Amman, 2009.
6. Hindawi, Ahmad Hashem: The possibility of using local materials to produce opaque ceramics, unpublished doctoral thesis, University of Baghdad, 1996.
English Sources:
1. Athur Dodd: Dictionary of Ceramics, Third Edition, The Institute of Materials, London, 1994.
2. H. Smith: High Performance Pigments, Wiley-VCH Verlag, Weinheim, Germany, 2002.

3. Naseef. J. Ali: The Chemistry of Ceramic Glazes, Thesis of Doctor of Philosophy, University of Aston in Birmingham, UK, 1983.
4. Philippe Blanchart: Simulation for Ceramic Glaze Formulation, GEMH CO., France, 2015.
5. Robert. B. Heimann, Classic and Advanced Ceramics From Fundamentals to Applications, GmbH & Co, Weinheim-Germany, 2010.
6. S. Marfunin: Physics of Minerals and Inorganic Materials, New York, USA, 2000.
7. Stephen Westland, Computational Color Science, University of Pennsylvania, USA, 2004.
8. W.D Callister, Materials Science & Engineering an Introduction, John Weley, USA, 2000.
9. Biswas SK, & Others: Chemical synthesis of environment-friendly nanosized yellow titanate pigments, Materials Research Bulletin, No: 43, 2008.
10. C. Sonnichsen & Others: Drastic Reduction of Plasmon Damping in Gold, Physical Review Letters, No: 88, 2002.
11. Roque J. & Others: Copper and silver Nano crystals in luster leadglazes: development and optical properties, Journal of the European Ceramic Society, No: 26, 2006.
http://en.wikipedia.org/wiki/Pyrometric_device

UNIVERSIDAD
DEL ZULIA

opción

Revista de Ciencias Humanas y Sociales

Año 35, Especial No. 22 (2019)

Esta revista fue editada en formato digital por el personal de la Oficina de Publicaciones Científicas de la Facultad Experimental de Ciencias, Universidad del Zulia.
Maracaibo - Venezuela

www.luz.edu.ve

www.serbi.luz.edu.ve

produccioncientifica.luz.edu.ve