Glazing and Coloring of Cellular Concrete Blocks

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Abstract

Thermostone is one of the important materials which have been spraying glazed using different glass mixtures based on alkaline (A_5), lead glasses (A_4) and their composition at different glass/water (G/W) ratios using a special holder have been designed to keep the glazing on top of thermostone and thereby, protect the other surfaces from damage. Physical and mechanical properties, color, roughness and other properties have been investigated with the aid of microscopic analysis. Duplex layers of A_5-glazed layer on pre-coated A_4-layer (total thickness of 1.4mm) proved their superiority among A_4-glazed layer (0.2mm) and unglazed surfaces, especially those glazed at G/W ratio of 30/70 where the standard thickness (1.5mm) for glazing of pours bodies due to the action of composition of A_5- glaze mixture and its effects in sealing the pores and thereby, improving all the properties. The glazing process in this study introduced a glazed thermostone with improved properties using spray technique by means of compressive strength ,porosity, hardness , water absorption and bulk density aspects.

1.Introduction

Thermostone is a construction material, which is commonly used in Iraq as a filling material in blocks, panels, ceiling panels, pre-cast exterior walls, void filling, roof insulation, thermal insulations, sound insulation, floors and low cost housing .It dose essentially consist of cement, sand and lime, which are mixed in a different propositions I.Q,S2000 . Thermostone is one of the important materials, which is also known as autoclaved cellular concrete (ACC), autoclaved lightweight concrete (ALC), autoclaved concrete(AC), cellular concrete(CC), porous concrete(PC) . AAC products include blocks, wall panels, floor and roof panels, cladding (facade) panels and lintels Simge2006 and W. van 2014 . The main advantage of manufacturing cellular AAC is to get high thermal insulating material Sasan 2011 with suitable density and compressive strength to be used as a lightweight units in masonry works Ali A.Hussain2012 . AAC is an environmentally friendly building material that is used to save energy and enhance the quality of the built environment TECHNOLOGY BRIEF 2010. There are different ways to improve the physical and mechanical properties of thermostone . Researches focus on solving the problems that occur during thermostone manufacturing , improve the physical properties and mechanical properties to qualify within the building materials by changing the composition or by additions or changing of temperature and porosity as well as for insulation applications. Glaze is a special type of glass, made for

coating ceramic products. Glazes are glass with various modifiers added to affect their behavior and appearance. Now days architecture is focusing on decoration and aesthetic properties because of the increased demands for such modern requirements. Furthermore, there are now few works being interesting in produced of a glazed bricks to reduce the cost and energy consumed in traditional masonry works such as coating , painting, ceramics covering and other finishing works. Thermostone is now becoming increasingly used in in construction and partitions works due to its superior properties mentioned above.Unfortunately, there is no technique right now could introduce an improved and decorated thermostone without any additional masonry works. The objectives of this study are to glaze the thermostone to exhibit it both improved and decorative properties by spray glazingwithdifferentglasses.

2.Experimental procedure

Thermostone blocks with dimensions of 30×30×30 mm supplied by "thermostone Karbala company" were selected as the raw materials in this study. Several trial mixtures were conducted to obtain the optimum mixture which can guarantee the glazing obtainment with the best result . The glazing trials were done using different percentage weights for the following materials (Lead, Alkali, Silica, China clay) , to be mentioned that the nominal size for all the trial mixture pass on sieve number 200. The tried glazing mixtures are shown in table (1-1) .

Table (1-1): The tried glazing mixtures

	China Clay wt%	Silica wt%	Alkali Glass wt %	Lead wt%	Mix. Type
A_1	50	50	———	———	
	10	10	———	80	A_2
A_3	30	70	———	———	
	20	20	———	60	A_4
——-	A5	100	———	———	

Samples A1 could give undesirable results in terms of appearance , shrinkage and distribution ,samples A2 could also give undesirable properties , samples A3 gave undesirable characteristics of appearance. It is obvious that inconsistencies between the glaze layer and the substrate , Samples A4 could not obtain the desired texture (smoothness), in spite of the existence of matching between the sample surface and the glass layer. The improvement in matching feature recorded for this mixture denotes that the lead weight percentage for this mixture which is quite high comparing with the other oxides, could be the most responsible oxide for this matching and finally, the mixture A5 could give the best result in terms of texture appearance and all the other

properties, thus all the works on glazing improvement and their tests were conducted using the mixture of samples A5 shows in fig.(1-0).

Fig(1-0): Samples of the mixture A_5

3.The chemical composition of the trial mixture A_5

A pre-mixed 100g Alkali glass was used in the glazing process. Table (1-2) shows it's chemical analysis .

Table(1-2):Chemical composition of mixture A_5

	SiO_2	Al_2O_3	B_2O_3	CaO	BaO	Na_2O	K_2O	Element
%	2.2	11.2	6.3	14.1	13.7	7	45.2	

Ceramics stains or pigment were also added to the mixture of alkali glass with percentage 5% and as shown in Table (1-3)

Table(1-3):Chemical composition of ceramics stains

	K2Cr2O7	Na2O.2B2O3.10H2O	SiO2	CaCO3	SnO2	pigment
%	50	25	18	4		3

- Optimization of mixture A_5

Several and consequence attempts were carried out to get the best smoothness and the best match on mixture A_5. It was found that the best results can be produced by painting the thermostone sample surface with a thin layer of lead thickness of (0.2) mm, to obtain a match (less shrinkage) between the glass layer and the sample surface, before spraying with the coated glazing (mixture A_5) with thickness of (1.4) mm. Then, different weights of alkali glass A_5 powder and mixture A_4 with different weights of water were used to investigate the flow of curdled glass at different times of sprayed and constant thicknesses, the greater the ratios of glass to water, the less spray time as illustrated in the Table(1-4).

Table (1-4): Optimization of mixture A_5

Thickness A_5 mm	Thickness A_4 mm	Spray Time sec	Percentage (G / W) %	Glass(G) g	Water(W) g	No.
1	90	10	10/90	35	0.2	1.4
1.4	0.2	25	30/70	30	70	2