OBTAINING GLASSY COATINGS FROM RECYCLED GLASS FOR BUILDING BRICKS

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ABSTRACT

Glassy coatings were prepared from transparent recycled glass and fritted borax for application to building bricks. The stoichiometries used exhibited good bonding behaviour to the red ceramic body. The fritted borax contributed efficiently to lowering softening temperature compared to the use of non-fritted borax, with a difference of up to 160°C. The values for abrasion loss were 0.21% compared to 3.98 % of the unglazed pieces, obtained with a specially designed apparatus. The optical absorption measurements were obtained by melting different compositions on single crystals of MgO, using a Perkin Elmer Lamda UV-VIS spectrometer. The samples exhibited a good response to transmission in the visible region and a great optical absorption above 350 nm.

INTRODUCTION

Preliminary research has shown the possibility of coating ceramic bricks with a glaze consisting of recycled glass and lead-free borax, using acetone as the application vehicle, whose use has industrial limitations.

According to Zachariasen, glasses are made up of different oxides, classified as basic oxides (RO), neutral oxides (R_2O_3) and acid oxides (RO_2), the sum of the basic oxides being equal to 1, on which the so-called Seger unity formula is based: RO { R_2O_3 { RO_2 . Having obtained the different moles, the results were compared with the curve proposed by Rhodes, where the behaviour was observed of boron oxide, the basic, neutral and acid oxides. The basic oxides RO and RO_2 must have a total content of one mole; the neutral oxides R_2O_3 can vary between 0.1 and 1.4 moles and correspond to 1/10 of the weight of silica according to Vittel, and in the acid oxides RO_2 and R_2O_3 the proportion can range from 1.5 to 14 moles. The boron oxide mole range lies between 0 and 2.

MATERIALS AND METHOD

The transparent glassy coatings listed in Table 1 were prepared, and composition (50 - 50) was chosen as the optimum working composition. The compositions were mixed in an agate mortar and the prepared glaze was applied with water as a vehicle in three layers as recommended by Vittel, changing the direction in each layer. The test specimens were then subjected to single firing in a temperature-controlled tubular kiln.

To determine the abrasion wear, the weight loss method was used, in which the piece is subjected to brushing with a wire brush. Brush pressure was 1.36 kg. After saturating the pieces in water and drying them in an oven at 70°C to constant weight, the pieces were subjected to brushing in the apparatus for 10 cycles, after which they were cleaned, saturated again and dried to obtain their end weight.

The optical absorption measurements were performed by melting the glazes with different compositions on single crystals of 0.5-cm-thick MgO with a 0.5 cm x 0.5 cm surface area, on a Perkin Elmer Lamda 11UV-VIS spectrometer in the 250 to 900 nm range.

ANALYSIS OF RESULTS

Table 1 presents 3 of the tested stoichiometries, with their respective liquidus temperatures and corresponding moles. On using the fritted borax, the maturing temperature of this type of glaze was found to drop with regard to the ones in which dehydrated borax was used, which was about 1000 °C

NO.	GLAZE COMPONENTS		TEMPERAT. °C	MOLES			
	GLASS %	BORAX %		Ca O	Na_2 O	Sl O_2	B_2 O_3
1	40	60	875	0.167	0.833	1.003	1.331
2	50	50	930	0.215	0.785	1.289	1.141
3	55	45	960	0.240	0.760	1.438	1.041

Table 1. *Glaze components, liquidus temperatures and moles.*

A stoichiometry was chosen of 50 % glass - 50 % borax owing to its working temperature of about 900°C, which approaches that obtained in the artisanal kilns operating in the region of San Juan de Pasto, Nariño, Colombia. Table 2 sets out the abrasion loss values.

BRICK NO.	STARTING WEIGHT	DRY END WEIGHT (GR)	CORRECTED DRY WEIGHT (GR)	WEIGHT LOSS (%)
1	2794	2887	2790	0.14
2	2536	2620	2531	0.20
3	2658	2745	2653	0.18
4	2685	2774	2679	0.22
5	2563	2645	2556	0.27

Table 2 *Example of a wear test on a glazed ceramic bricks.*

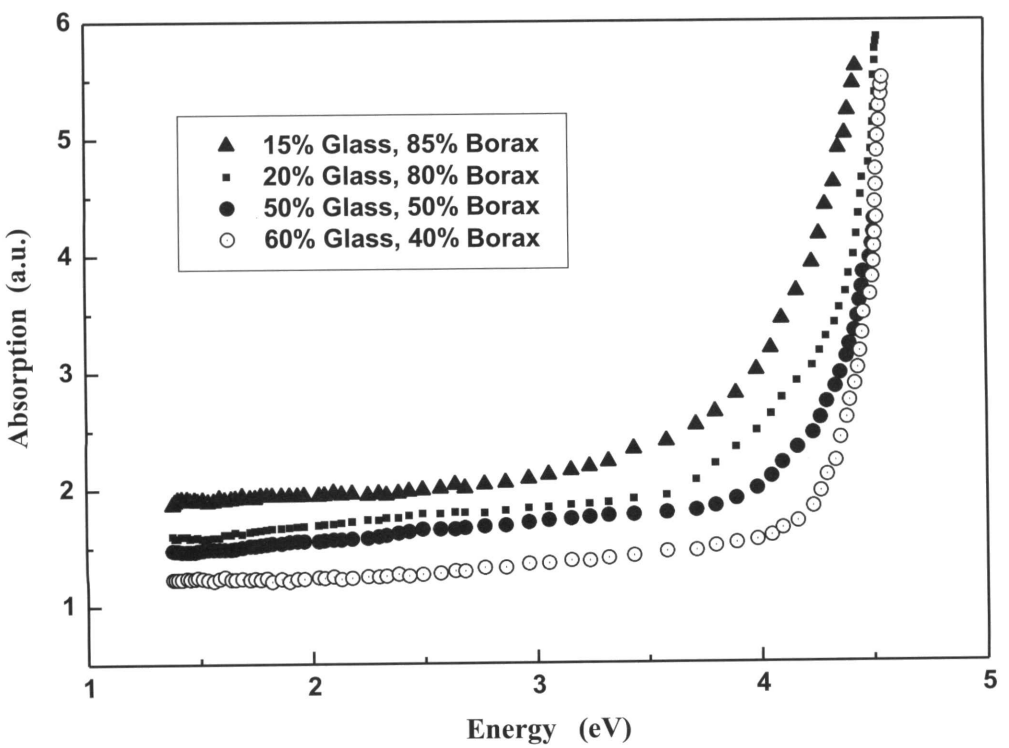

Figure 1. *Absorption spectra for different recycled glass compositions and fritted borax.*