烧结时间和温度对烧结粘土砖物理性能的影响

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摘 要：砖是世界上使用最广泛的传统建筑材料之一。粘土砖的生产成本受到烧制所需能源成本的显著影响。本研究的目的是研究不同烧成温度对吉马镇周围生产的烧结粘土砖的抗压强度（CS）、吸水率（WA）和饱和系数（SC）的影响，并评估制砖过程中的烧成工艺对粘土砖性能、颜色和外观的影响。在生产过程中，分析了不同加热速率对烧结标准砖物理力学性能的影响。在本研究中，使用了不同的加热速率：慢加热速率和快加热速率。评估了烧结粘土砖的物理和力学性能随烧结温度和烧结时间的增加而发生的变化。结果表明，CS 随焙烧温度的升高而增加。相反，烧结粘土砖的 WA 和 SC 随着烧结温度的升高而降低。烧制持续时间的增加会略微增加 CS，降低粘土砖的 WA。在研究区域，传统的砖生产商在烧结粘土砖生产中没有烧结温度控制装置或机制。窑操作员决定了焙烧温度和持续时间。该装置的缺失经常导致砖的过度或欠烧，这大大影响了这种广泛使用的收缩材料的工程性能。因此，传统粘土砖生产商应在其窑上安装温度控制装置，或者至少需要接受如何近似确定最佳温度的培训。
关键词：烧结粘土砖；CS；烧成温度；饱和系数；吸水率

Effects of Firing Time and Temperature on Physical Properties of Fired Clay Bricks

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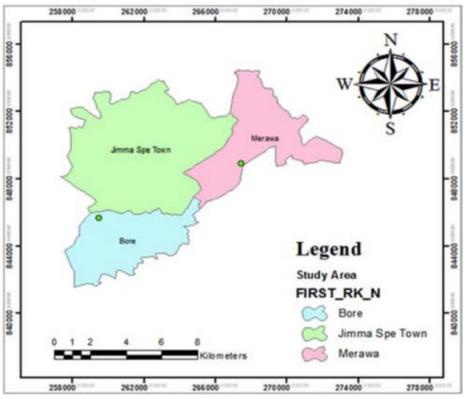
Abstract: Brick is one of the most widely used conventional construction materials throughout the world. The production cost of clay brick is significantly affected by the cost of energy required for firing. The aim of this research is to investigate the effects of different firing temperatures on the compressive strength (CS), water absorption (WA) and saturation coefficients (SC) of fired clay bricks produced around Jimma Town and evaluate the effect of firing processes in brick manufacturing on the properties, color and appearance of the clay brick. During the production process, the effects of different heating rates on physical and mechanical properties of firing standard bricks were analyzed. In this study, different heating rates were used: slow heating rate and fast heating rate. Changes in the physical and mechanical properties of the fired clay brick were assessed with the increase in the firing temperature firing time. The results show that the CS increased with the increase in the firing temperature. On the contrary, WA and SC of the fired clay bricks decreased with the increase in the firing temperature. Increment in the duration of firing slightly increases the CS and lowers both the WA and WA of the clay brick. In the study area, traditional brick producers did not have firing temperature control device or mechanism in the fired clay brick production. The kiln operator decided the firing temperature and duration. The absence of the device frequently results in the over or under firing of bricks greatly affecting the engineering properties of this widely used contraction material. Therefore, the traditional clay brick producers should install the temperature control device on their kiln or at least needs to be trained how to approximately determine the optimum temperature.
Keywords: Burnt clay brick; CS; Firing temperature; Saturation coefficient; Water absorption

1.引言

[1 4 5 7]

2%[2 12] 3000

[4 11 14 15]



76.0% 1.

82.4% 2.2.

74.8% 9% 1%

9.1% 6.3% 2 1

<10%
0.1%

[11-12]

[1]

2. 2016 2

CS WA

SC

2.样本收集和数据分析

2.1. 2.2.1.

Marawa Bada Buna

Bore Askola 1

25 cm x 12

cm x 6 cm

25 cm x 12 cm x 6 cm

2.2.2.

2.2.3.

3 700 970 1200℃

3.

970℃

2 4 6 8

2.2.4.

CS WA SC

[3 8]

Soil sample	LL	PL	PI	Specific gravity (g/cm^3)	Water used for mixing (% by weight)
Beda Buna	38	28	10	2.5	30
Askola	62	40	22	2.48	47

1.

2.3.

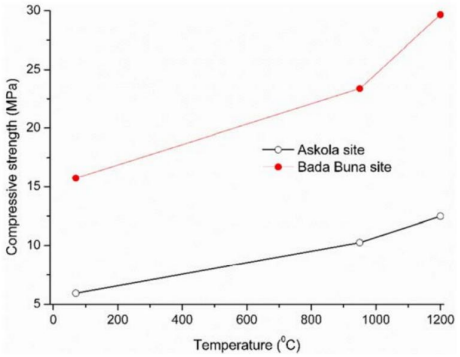
Bada Buna

Asko la

3.结果和讨论

CS WA SC

CS 4



4. CS

Bada Buna Askola

CS 700℃ 1200℃

CS 700℃ 4

2

CS 700℃

970℃ CS CS

5

Raw materials	Firing Temperature (℃)	Mean CS (MPa)	Classification (ES 86:2001)	ASTM
	700	15.74	B	NW
Bada Buna	970	23.37	A	SW
	1200	29.67	A	SW
	700	5.93	-	-
Askola	970	10.25	C	-
	1200	12.48	C	SW

2. CS

CS Bada Buna

970 1200℃

Askola CS Bada

Buna CS CS

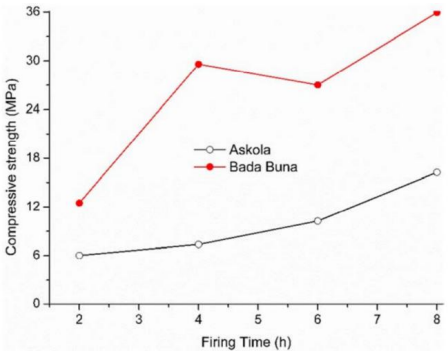
700 970℃

CS CS

CS

120℃ Askola Bada Buna

CS



5. 970℃ CS

970℃ Bada Buna Askola CS 3

Raw materials	firing temperature (°C)	Mean WA and brick classification			Mean SC and brick classification		
		WA (%)	(ES 86: 2001)	ASTM	SC	(ES 86: 2001)	ASTM
Beda Buna	700°C	6.38	A	SW	0.76	A, B	SW
	970°C	6.52	A	SW	0.68	A, B	SW
	1200°C	8.80	A	SW	0.88	A, B	MW
Askola	700°C	17.35	A	MW	0.86	A, B	MW
	970°C	10.80	A	SW	0.66	A, B	SW
	1200°C	19.64	A	MW	0.84	A, B	MW

3. WA SC

Raw materials	Firing Temperature (°C)	Firing time (h)	Mean WA and brick classification			Mean SC and brick classification		
			WA (%)	(ES 6:2001)	ASTM	SC	(ES 86:2001)	ASTM
Bada Buna	970°C	2	10.01	A	SW	0.84	A, B	MW
		4	7.92	A	SW	0.69	A, B	SW
		6	6.57	A	SW	0.69	A, B	SW
		8	5.58	A	SW	0.69	A, B	SW
Askola	970°C	2	37.51	C, D	NW	0.96	A, B	NW
		4	26.31	C, D	NW	0.82	A, B	MW
		6	12.23	A	SW	0.75	A, B	SW
		8	11.89	A	SW	0.72	A, B	SW

4.Bada Buna Askola WA SC 970℃

[8 3]

WA

3 WA SC WA SC WA [8]

a ASTM

MW

[8 14]

2 3 Bada Buna 700℃

CS WA WA

B A A B

WA SC 3 Bada Buna

WA SC 970℃

4

WA SC

5

Sample site	Size of green bricks (cm)	Mean size of air dried bricks (cm)	Firing temperature (°C)	Mean size of fired bricks (cm)
Bada Buna	25 x 12 x 6	23.2 x 11.2 x 5.9	700	22.60 x 10.58 x 5.60
			970	22.80 x 10.54 x 5.34
			1200	22.62 x 10.26 x 5.36
Askola	25 x 12 x 6	23.1 x 11.4 x 5.7	700	22.60 x 10.54 x 5.40
			970	22.66 x 10.50 x 5.48
			1200	22.62 x 10.60 x 5.44

5.

4.结论和建议

1. Bada Buna

970 1200℃ Askola

900 970℃

CS WA WA

2. 2

8 CS WA SC

3. 970℃ 1200℃

ES 86:2001

CS WA SC

4.

5.

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