

New Generation Geopolymeric Bricks

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Padra Incubator Research areas of expertise:

- Waste management and construction materials
- Environment
- New generation bricks using waste-Derived aluminosilicate



Raw materials

+ Water

Mixing

Pressing

Drying

Heating
1000-1200 degree C

← Ordinary

12 h at least

24 h at least

Geopolymeric →

Resting 10 h

3-5 h

Up to 5 h

Raw materials

Reagents+additives

Mixing

Pressing

Drying

Heating
Up to 1000 degree C

Raw materials:

1-Kaoline:the Kaoline based bricks were made with local kaoline from Esfahan

Chemical composition of kaolin

component	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	SO ₃	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	L.O.I
%	62.7	28.9	0.12	0.09	0.13	0.84	0.18	0.06	1.15	5.7

Si:Al=1.8-2 Kaolin%=5.7:14=40-41% weight

2- Alkaline based reagents

3-Local Shale of Esfahan

Chemical composition of shale

component	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	SO ₃	MgO	CaO	Na ₂ O	K ₂ O	L.O.I
%	40.83	22.66	19.25	0.13	0.46	1.43	0.69	0.96	9.43

Mixing

- Raw materials will be weighted accordingly based on the mixed design
- Materials will put into crusher respectively
- The water in the alkaline solution provides a reaction medium and assures the workability of the mixture during mixing and handling



Pressing

Hydraulic 300tons press machine with different molds sizes



Ordinary brick's firing:

- Old **dome** type
- Gas consumption: 160-200 cubic meter per ton bricks.
- Process duration: 24-48 h + 12 h drying = 36-60 h

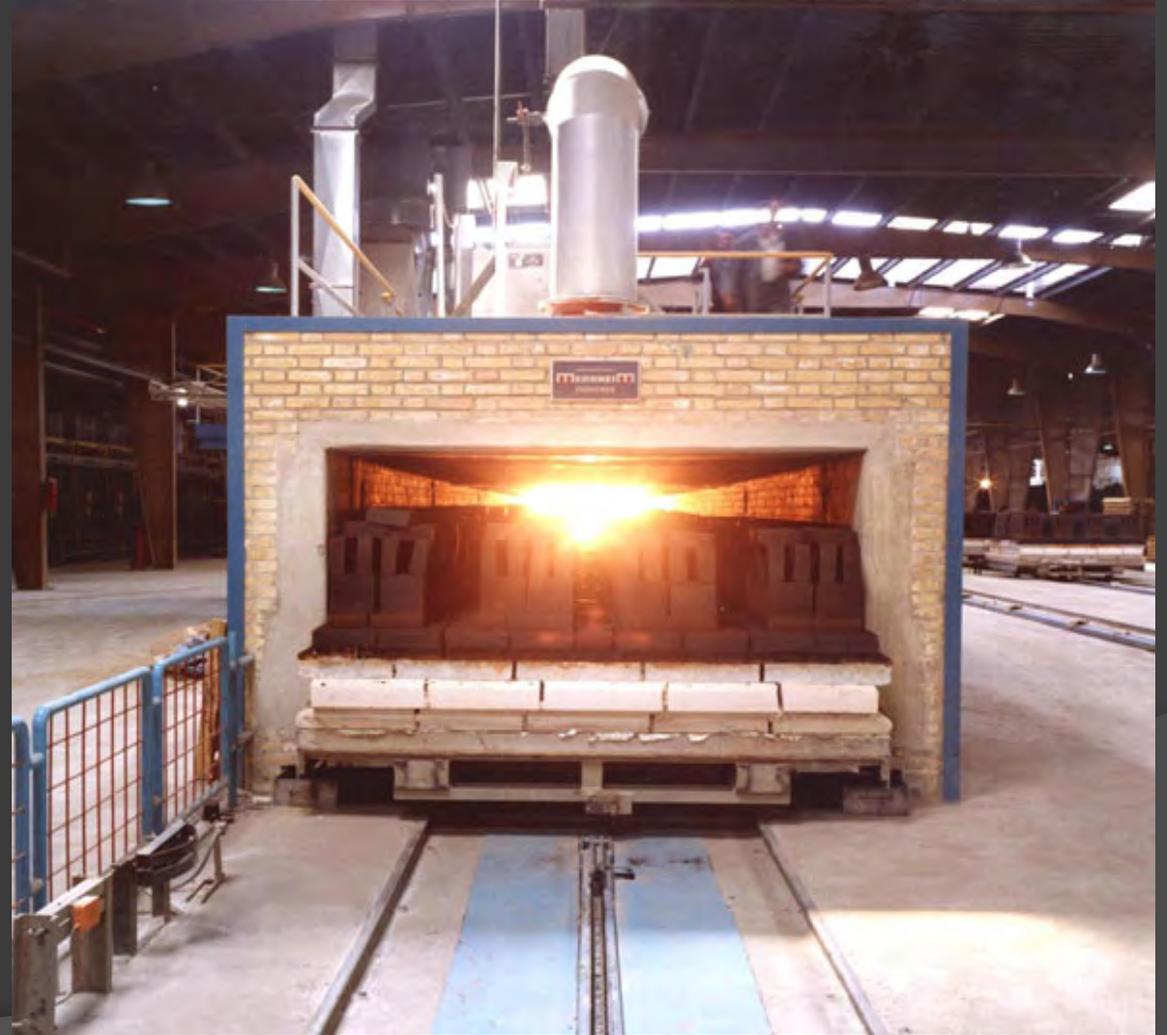
Geopolymeric brick's firing:

- Old dome kiln
- Gas consumption: 50-60 cubic meter per ton bricks
- Process duration: 10-15 h (the whole process)

Old dome kiln



Tunnel kiln



Standard parameters

	individual	Average
Compressive Strength MPa	11 (min)	14 (min)
Boiling water absorbtion(%)	*8-20	8-18
Active soluble salts%	-	0.6(max)
Freeze/thaw Resistance(weight loss%)	-	<3
Modulus of rupture(kg/cm ²)	35(min)	40(min)

M = Modulus Of Rupture

P = Breaking Load

L = Distance Between Knife Edges on which the Sample is Supported

b = Average Specimen Breadth

d = Average Specimen Depth

$$M = \frac{3 \times P \times L}{2 \times b \times d^2}$$

Standard test report

	individual	Average
Compressive Strength (MPa)	24.5	27.6
Boiling water absorption(%)	*8.1	8.4
Active soluble salts%	-	0.2
Freeze/thaw Resistance(weight loss%)	-	0.4
Modulus of rupture(kg/cm ²)	48	53

*water absorption could be less but in case of bricks we needed at least 8%

Benefits of geopolymeric bricks

- High Energy efficiency
- High Compressive strength
- High Modules of rupture
- Low shrinkage
- Fast setting
- Acid resistance
- Fire resistance
- low thermal conductivity





Next generation bricks
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