

Panels and tiles from glass-ceramics for interior and exterior uses

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1. Introduction

Technology of manufacturing and utilization glass ceramic materials (a crystallized material of better properties than natural marbles) was acknowledged by the end of 19th century. Especially in the United States of America and Europe countries. Such materials were used in several industrial sectors, such as construction, housing furniture, medical and army tools. This was due to the high chemical, thermal, electrical, and mechanical properties which characterize the product.

Glass-ceramic has several advantages over conventional powder processed ceramics, such as very low or null porosity, as well as uniformity and reproducibility of microstructure. The crystalline phases precipitated in some glass-ceramics have, for instance, low thermal expansion coefficients coupled with high thermal and chemical stability and high mechanical strength.

Scientific researches in Tokyo – Japan, the institute of research in Russia, and Corning Glass Co. in the United States of America proved, that this crystallized material is more specified than the other natural marble and granite products. Mostly in its hardness, chemical resistance, and water absorption, etc. as listed in (Table 1)

Although natural marbles are difficult to be quarried and processed, there is a growing need for such materials. It is possible to prepare artificial marble-like products in the form of panels and tiles, characterized by high crushing strength, high abrasion and weathering resistance these products enable the use of cheap conventional raw material as the main constituents, therefore they will have competitive selling price.



Samples of the tiles that could be manufactured

Table I Comparison between Properties of glass-ceramic panel and natural stones

Property	Glass-Ceramic panel	Marble	Granite
Specific gravity g/cm^3	2.7	2.7	2.7
Bending strength Kg/cm^2	510	170	150
Compressive strength ton/cm^2	1.2-5.6	0.9-2.3	0.6-3.0
Charpy impact strength Kg.cm/cm^2	2.5	2.1	2.0
Young's modulus $\times 10^7 \text{ Kg/cm}^2$	5.2	2.8-8.4	4.3-6.1
Moh's hardness	6.5	3-5	5.5
Specific heat $\text{cal/g. } 50^\circ\text{C}$	0.19	0.19	0.19
Thermal exp. coeff. $30-380^\circ\text{C, } \times 10^{-7}/^\circ\text{C}$	62	80-260	50-150
Thermal conductivity $\text{Kcal/m.h.}^\circ\text{C}$	1.4	1.9-2.0	1.8-2.1
Water absorption rate %	0.00	0.30	0.35
Acid resistance, 1% H_2SO_4 wt.loss% . 25°C , 650 h	0.08	10.3	1.0
Alkali resistance. 1% NaOH wt.loss% . 25°C , 650h	0.05	0.30	0.10
Freezing resistance wt.loss%	0.028	0.23	0.25

2. Objectives of the project

The objectives of this project include:

- Establishment of a new technology in Middle East and in Africa for production of a new product.
- Presents products that could be exported to the above markets.

- Providing the Egyptian market with a high performance panels and tiles that could compete with the already present products to get reasonable profit.

3. Technology of production

Glass-ceramic technology is based on controlled crystal nucleation and growth in certain glass compositions. In the first stage batches composed of powdered raw materials and commercial chemical reagents are melted and chilled to form frits. The obtained frits are ground and shaped into green tiles. Local raw materials are used for the production of cheap products. The raw materials constitute the main part in the batches. They represent more than 85% of the batch. In addition to these raw materials, some technical grade chemical reagents were added as nucleating agents. In a second stage the green tiles are heat treated by passing through a special furnace which raise the temperature to an intended one then cools gradually. The following are the manufacturing steps in details.

A) Raw materials and batch preparation

The glass batch materials according to the intended composition are weighed and mixed to ensure batch homogeneity. The mixed batch is then transferred to the melting unit.

B) Melting and Glass frit Manufacturing

The glass batches are melted at 1450 -1500°C In a tank furnace and the molten glass is permitted to flow immediately into a water basin for quenching and becoming frit. The frit is dried and then milled in a high speed ball mill then transferred to the shaping and creaming unit

C) Ceraming process

The fine glass powder (Frit) is shaped by pressing in molds of specific dimensions into tile forms. After forming and pressing of the frits into green tiles, they are treated thermally at a temperature of 800 to 900 °C then cooled to room temperature to get the solid panels and tiles.

If needed the solid panels tiles are transported to grinding and polishing unit to get shiny product, then to the packing and loading section and being transferred to the customer.

4. Product profile

Material: Glass Ceramic

Brand name: Glasceram Panel

Size: depend on the demand

Properties

1. Colored or white
2. Proof performance of chemical durability
3. High strength
4. High abrasion resistance

Uses

- Internal Floor tiles,
- External Hard facing tiles, in buildings, offices, malls, Metro platforms, and factories.

Best regards

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