

Glass Mosaic vs. Unglazed Ceramic Mosaic

Physical Characteristics &
Performance Comparison

- A Case study by Carter Glass Ind. Corp. -



<http://www.cartermosaic.com>

Objectives & Methods

Objective

- Study aims to provide some metric comparison between Standard Glass Mosaic and Unglazed Ceramic Mosaic tiles for exterior and interior finishing

Methods

- Quantitative data presented in the following pages are based on:
 1. Actual test results according to ANSI and ISO guidelines as well as information published by professional organization such as the American Society for Testing and Materials and the Tile Council of America
 2. Vendor supplied information
- Qualitative data presented are based on market research and professional industry experience

Material Basics

- Glass mosaic tiles
 - Mainly composed of silica sand, is dense, impervious to water and has a smooth surface texture
 - Glass-like crystalline formed from molten glass and other coloring oxides at a temperature above 1000°C, shaped into mosaic size squares by roller or press molds
 - Tiles can be made to be transparent, translucent or opaque. Color is blended into the body of the tiles and will not fade over time
 - It may not be suitable for heavy commercial installations where maximum durability is required

Material Basics, Cont.

- Unglazed ceramic mosaic
 - Ceramic tiles are generally made of clay from non to slightly porous with a very low water absorbency, either fine grained or with an abrasive mixture throughout
 - There are two major types of tile. The first is quarry tile, which is made by extrusion -also termed the “wet” process - from natural clay or shale. The second is made by the pressed-dust or “dry” method
 - Ceramic mosaic is a very durable tile type, with above average slip resistant characteristics, and is suitable for most exterior and interior horizontal and vertical applications.

Comparison Summary Chart

■ Physical Characteristics Summary

Criteria	Glass Mosaic	Unglazed Ceramic Mosaic
Physical Form (成型)	Good	Better
Range of Color (色系變化及色感)	Significantly Better	Good

Physical Form:

相較於玻璃馬賽克在1000°C以上的高溫以模具壓製一體成型，石英馬賽克的成型過程在較低溫的環境下以兩道程序製作，較容易掌控顆粒的平整度、邊直度和直角度等精準度

Range of Color:

玻璃馬賽克的色系變化較豐富，色感也較石英馬賽克更具變化性 (玻璃特有的色彩光感)

Comparison Summary Chart

■ Performance Summary (Exterior Use)

Criteria	Glass Mosaic	Unglazed Ceramic Mosaic
Water Absorbency (吸水率)	Impervious (0.00%)	Vitreous (0.5% to <3.0%)
Thermal Shock Resistance (耐急冷急熱)	Resistant	Resistant
Chemical Resistance (抗化學腐蝕)	Excellent	Good

Water Absorbency:

玻璃馬賽克的密度較高，石英馬賽克的成型相較下以高壓 Dust-Pressed 粉狀顆粒成型

Thermal Shock & Chemical Resistance :

玻璃馬賽克的化學穩定性及冷熱穩定性均高於石英馬賽克

Comparison Summary Chart

■ Performance Summary (Interior Use)

Criteria	Glass Mosaic	Unglazed Ceramic Mosaic
Surface Hardness (表面硬度)	MOHS SCALE: 6	MOHS SCALE: 5 - 7
Abrasion Resistance (耐磨耗度)	Resistant PEI Rating: Class IV	Resistant
Crazing Resistance (耐熱耐壓度)	Resistant*	Resistant*

Surface Hardness:

石英馬賽克的摩氏硬度因成分及製程的不同，測試結果會因而不同

Crazing Resistance :

標準測試方式以Glazed Tile Surface 為基礎，因而較不適用於兩者間的比較

Comparison Summary Chart

■ Performance Summary (During & After Installation)

Criteria	Glass Mosaic	Unglazed Ceramic Mosaic
Bonding with Portland Cement Mortar (黏著度)	Good	Good
Breaking Strength (抗折度)	No relevant test results	No relevant test results
Ease to peel off mounting paper (脫紙時間)	Depending on glue and paper type	Depending on glue and paper type

Breaking Strength:

標準測試方式以最小一平方英吋(6.45cm²) 的表面面積材料進行 3-point force application，兩者間的標準尺吋規格不符合測試基礎因而不適用於交叉比較

Comparison Summary Chart

- Other Subjective Factors Summary

Criteria	Glass Mosaic	Unglazed Ceramic Mosaic
Economic factor (Cost of material)	Lower (below \$20 / sq ft.)	Higher (above \$40 / sq ft.)
Economic factor (Cost of installation)	Higher, if follow standard installation procedure	Lower
Durability (持久性)	Pass (actual project cases of 20+ yrs)	Not Enough Data to support proof

Durability:

Accelerated aging study such as Exposure to UV light, IV. Accelerated Weathering effects on a material when exposed to sunlight and moisture etc.

appendix

Physical Characteristics

- Dimensional attributes:
 - Side straightness
 - Corner squareness
 - Flatness
 - Thickness
 - Wedging
 - Dimensional specification uniformity
- Indicates the overall aesthetic consistency, especially at a close viewing distance

Performance Attributes

- Surface Hardness
 - Tested with the Mohs scale
 - is the capacity of the tile surface to resist scratching and etching
 - Under EN 101 standard, tiles are classified on a scale of 1 to 10 based on the increased hardness of the minerals used to scratch them.
- The higher the Mohs hardness of the tile surface, the less risk that objects and other materials can scratch or etch it permanently
 - The MOHS hardness scale is as follows :
 1. Talc
 2. Chalk
 3. Calcite
 4. Fluorite
 5. Apatite
 6. Feldspar
 7. Quartz
 8. Topaz
 9. Corundum
 10. Diamond

Performance Attributes, Cont.

- Water Absorbency
 - ASTM C373 describes the standard test method for determining whether a tile is impervious, vitreous, semi-vitreous, or non-vitreous
 - Results are expressed as a percent of the weight of water absorbed into the weight of dry tile
 - This test is critical in categorizing the tile both in the ISO and the ANSI specification.
- Generally, tile with lower absorption rates are easier to maintain because they are more resistant to staining. They do not readily absorb grease, chemicals and other staining agents
 - Impervious tile has a water absorption reading of 0.5 % or less
 - Vitreous tile: more than 0.5 %, but not more than 3.0 %
 - Semi-vitreous: more than 3.0 % but not more than 7.0 %
 - Non-vitreous tile has a water absorption reading of more than 7.0 %

Performance Attributes, Cont.

- Thermal Shock
 - ASTM C484 describes the standard test method for determining a tile's ability to withstand exposure to high temperature and rapid cooling
 - This test submits a tile to rapid temperature variation
 - Tile should show not display physical failure such as hairline cracks, or the body of the tile showing evidence of disintegration
- This demonstrates the tile's ability to withstand such things as:
 - (Interior use) a hot pan on a counter top; hot water applied to a cold floor or cold water applied to hot tile such as a sauna environment
 - (Exterior use) cold water applied to hot tile, such as a sudden summer shower on a 40 °C day

Performance Attributes, Cont.

- Freeze Thaw Cycling
 - ASTM C1026 describes the standard test method for determining a tile's ability to withstand extreme weather conditions
 - This test submits a tile to repeated cycles of freezing and thawing simulating weather patterns such as those found in central and Northern US
 - Tile should show not display physical damage
- Demonstrates whether a tile is frost-proof and its ability to resist damage or deterioration when tested in freezing and thawing situations
 - (Exterior use) Exterior wall tile in extreme winter weather through freeze-thaw cycles

Performance Attributes, Cont.

- **Crazing Resistance**
 - ASTM C424 describes the standard test method for determining the ability of ceramic tile glazes to withstand exposure to high pressure steam without cracking or "crazing"
 - This test submits a tile to heat and pressure (in an autoclave) and the results to the glazed surface are observed
- This determines the tile's surface to withstand heat and pressure such as steam cleaning, or placement of a hot pan on a tile counter top. Glazes which resist crazing by this test usually will not craze

Performance Attributes, Cont.

- Abrasion Resistance

- ASTM C1027-84 describes the standard test method for determining visible abrasion resistance of glazed ceramic tile

- This test applies only to glazed tiles and is based on the P.E.I. rating system. A number of sample pieces are subjected to rotation with an abrasive material on their surface

- This determines the tile's surface resistance to friction such as the wear and tear of floor tiles.

- **Class 0** - Decorative use only, Not recommended for use on floors
- **Class I** - Light Traffic, for residential bathroom floors, no direct outside access
- **Class II** - Medium - Light Traffic, residential interiors with the exception of kitchens, stairs, landings and areas near external entries
- **Class III** - Medium - Heavy Traffic, All residential applications. Commercial applications which are similar in traffic to residential applications. Specifically excepted are areas of prevalent circulation or turning points
- **Class IV** - Heavy Traffic, all residential and most commercial applications such as the public areas of exhibition halls, hotels, restaurants, supermarkets, shops and schools
- **Class V** - Extra Heavy Traffic, all residential and commercial applications similar to class IV where extra durability may be required. Commercial usage, Industrial Applications

Performance Attributes, Cont.

- Resistance to chemicals
 - describes the standard test method for determining a tile's resistance to Chemical substances
 - This test submits a tile to various chemical agents and is critical in categorizing the tile both in the ISO and the ANSI specification (either ASTM C650 or ISO Test methods 10545-13)
- This demonstrates a tile's ability to withstand damage from chemicals such as acids, alkalis and swimming pool salts etc.

Performance Attributes, Cont.

- Bond Strength
 - describes the standard test method for determining a tile's bonding strength to Portland Cement Mortar
- This demonstrates the force required to shear a tile bonded to a Portland Cement Mortar bed from the bed

Performance Attributes, Cont.

- **Breaking Strength**
 - ASTM C648 describes the standard test method for determining the force required to break a tile that is suspended on three points
 - ISO Test Method: The ability of a material to resist breaking or rupture from a tension force
- This demonstrates a tile's ability to withstand installation procedures, such as the beating-in process to develop proper bond with the substrate
 - Minimum breaking strength for wall tile is 90 pounds and 250 pounds for all floor tile
 - Higher breaking strengths usually indicates a better ability to withstand impact and breakage once installed