

Glass-Ceramics as Imitation Gems

Wasura Soonthorntantiku¹ (wsoontho@gia.edu), Wim Vertrie¹ (wvertrie@gia.edu), Pichaporn Clarke² and Karen Avakyan²

¹GIA Thailand and ²Formica Group, Thailand

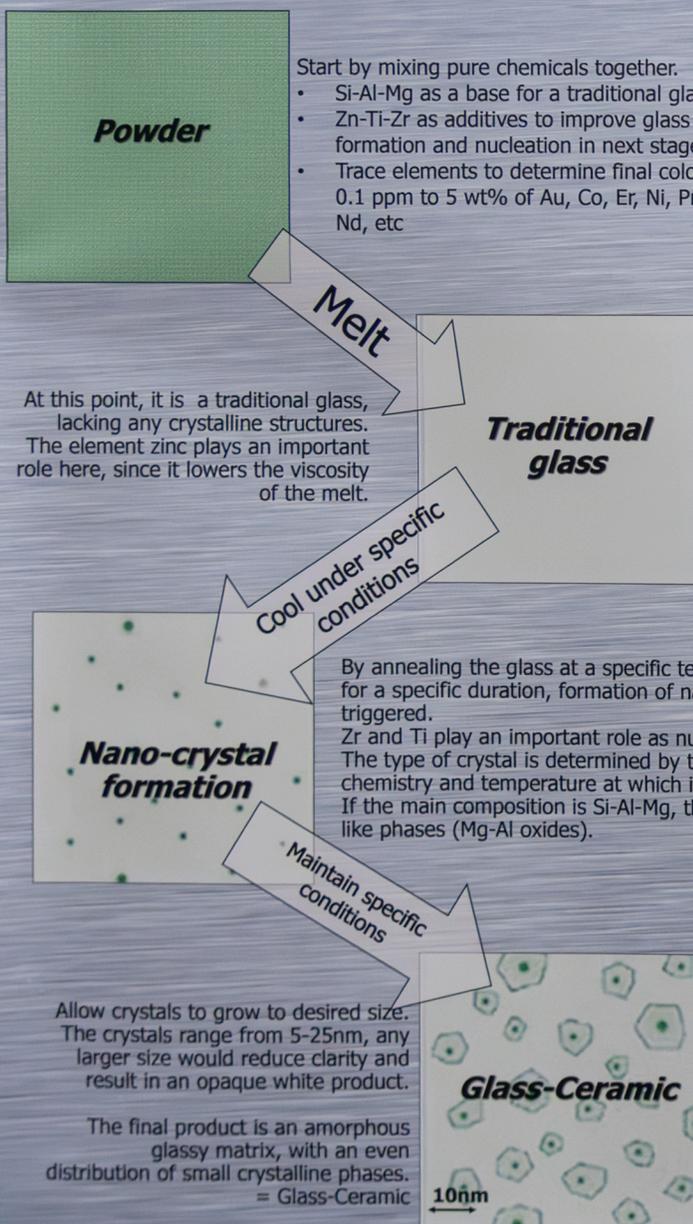
What is a Glass-Ceramic?

Glass-ceramics are materials consisting of crystalline phases dispersed in an amorphous glass matrix. They combine properties of glasses and ceramics, which makes them very suitable for many industrial applications.

Certain properties make them very suitable to use as imitation gems.

- Compared to traditional Glass, Glass-ceramics resists daily wear better due to higher hardness and higher toughness.
- Like traditional Glass, they are cheap to produce and can be made in any color and transparency.
- Like Ceramics, they are very resistant to high temperatures and temperature shocks. This allows for direct casting during the manufacturing and efficient jewelry assemblage/repair.

How to make Glass-Ceramics?



Challenges in identifying Si-Al-Mg Glass-Ceramics

Glass-Ceramics are defined by their structural state (glassy matrix with microcrystalline phases).

They can be made in different chemical compositions, resulting in very different products with variable properties.

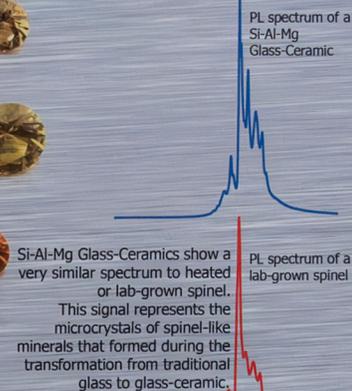
In theory, any combination of elements can be used to create a glass-ceramic. The most common composition used for jewelry applications is a combination of Si-Al-Mg which results in a glass with spinel-like microcrystals.

Identification relies on a combination of advanced techniques.

The basic gemological properties are not conclusive, and overlap with many common natural stones, glass, synthetic stones and other imitations.

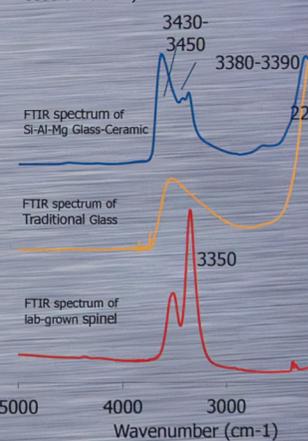
Density	Refractive Index	Polariscope	Inclusions	Fluorescence
2.85-3.42	1.60-1.63 (SR)	SR to ADR AGG for translucent stones	Clean, Cloudy patches and small bubbles	Inert (LW) weak chalky (SW)

Photo-luminescence spectrum at room temperature

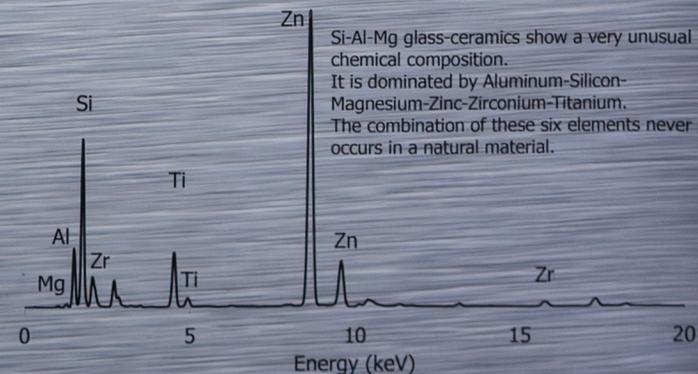


FTIR spectra

Si-Al-Mg Glass-Ceramics show a distinct FTIR spectrum. It shows features that have similarities with those of glass (large absorption cutoff around 2200cm⁻¹) as well as crystalline spinel (peaks around 3350-3450 cm⁻¹).



EDXRF spectrum



Any color and clarity
Loupe-clean
RI of 1.60-1.63 and PL spectrum of spinel
FTIR: 2200 cm⁻¹ shoulder and 3430+3380 cm⁻¹ doublet
Si-Al-Mg-Zr-Zn-Ti composition