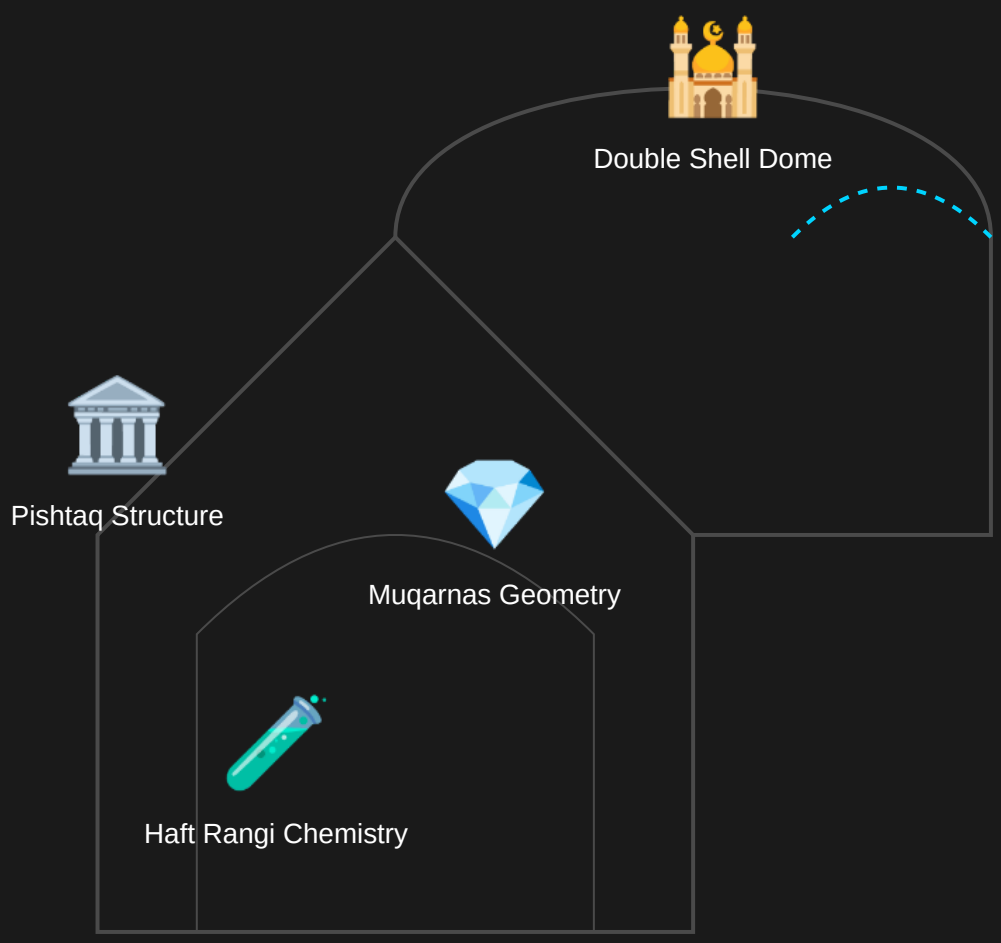

Vectree

Structural analysis and tile chemistry of Timurid period Islamic architecture

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Double Shell Dome Structure

Timurid domes, like those of the Gur-e-Amir, are masterpieces of structural engineering featuring a double-shell design. The internal shell provides the structural support and ceiling for the interior space, while the external bulbous shell is elevated on a high drum to create a monumental visual impact. This separation allowed architects to create towering silhouettes without compromising the internal acoustic or thermal properties. The two shells are often linked by internal wooden or brick ribs that act as stiffeners, distributing the immense lateral thrust generated by the masonry.

Haft Rangi & Cuerda Seca Chemistry

The vibrant blues of Timurid architecture result from sophisticated chemical mastery. ‘Haft Rangi’ (seven colors) tiles required complex glazing techniques where different mineral oxides were fired together. Cobalt oxide was the primary source for the deep lapis blue, while copper oxide produced the turquoise. The chemistry of the ‘Cuerda Seca’ technique involved using a waxy line of manganese and oil to prevent different colored glazes from running together during firing. The glazes themselves were typically tin-opacified, creating a reflective, glass-like surface that resisted the harsh weathering of the Central Asian steppes.

Muqarnas Geometric Transition

Muqarnas, often called ‘stalactite’ vaulting, serves both an aesthetic and structural purpose. In Timurid buildings, they provide a smooth transition between the square base of a room and the circular dome above (the ‘squinch’). Each tier of the muqarnas is a corbeled element that projects further than the one below. Chemically, these were often made of plaster or terracotta and finished with intricate tile mosaic. The geometry is based on complex subdivisions of squares and triangles, allowing for a modular construction that could distribute weight while creating an infinite play of light and shadow.

The Pishtaq (Monumental Portal)

The Pishtaq is the towering rectangular frame surrounding the Iwan (the vaulted hall). In Timurid architecture, these reached unprecedented heights to symbolize the power of the dynasty. Structurally, the Pishtaq acts as a massive screen wall that helps stabilize the vaulted space behind it. It utilizes deep foundations and thick brickwork to withstand the seismic activity common in the region. The facade is typically covered in Banna’i technique, where glazed tiles alternate with plain bricks to create geometric ‘Kufic’ calligraphy, integrating structural masonry with decorative protection.

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