

*Makkah Clock Tower,  
Makkah, KSA*

**The Makkah clock tower, the central tower of the Abraj-al Bait development in Makkah, KSA, features FRP composite materials and structural engineering from advanced composite specialists Gurit.**

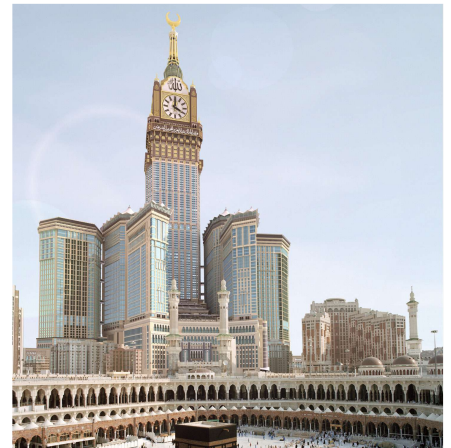
At 607m tall the building is the second tallest in the world. The top 200m of the tower is clad with over 40,000m<sup>2</sup> of advanced FRP composite panels, including the largest clocks in the world - 43m in diameter, with 23m long minute hands. The cladding of the tower top includes intricate calligraphy and ornamental patterning, finished in glass and ceramic tiles. Illumination of the clock hands, clock faces and media wall, called for over two million LED's to be integrated into the cladding panels.

Gurit worked closely with the tower top designers, SL-Rasch (Stuttgart, Germany), to carry out the structural engineering of the composite tower top cladding, clock hands, and the 23m diameter crescent, a self-supportive FRP composite structure which is located at the top of the building. Gurit supplied a range of advanced composite materials, to Premier Composites Technologies (Dubai, UAE), the company that carried out fabrication and installation of the cladding, clock face, clock hands and crescent. This included a new fire retardant wet laminating system from Gurit, Ampreg 21FR which was developed for lamination of the façade.



Lamination was carried out on direct CNC cut moulds fabricated using Gurit's T-Paste tooling paste on a polystyrene blank block. The easy machining, low cure shrinkage and high level of detail achievable with T-Paste enabled rapid production of accurate direct moulds for the part production.

The clock hands presented a particular challenge due to their long slender geometry and the potential for high wind loading. The clock hands were manufactured using Gurit's WE91-2 carbon fibre prepreg material and Corecell™ T-Foam structural core. Gurit originally developed WE91-2 and Corecell™ T-Foam for use in modern large wind turbine blades. The excellent stiffness to weight ratio of the carbon WE91-2 prepreg combined with the mechanical properties, toughness and low resin uptake of Corecell™ structural core enabled the realisation of a lightweight, stiff clock hand.



Photos courtesy of SL-Rasch

Dr Mark Hobbs, Senior Engineer, Engineered Structures at Gurit comments, 'This has been a fascinating project to work on. It has presented numerous challenges, from the sheer scale and complexity of the project, to the integration of finishes and lighting into the cladding panels. It has been a pleasure to work as part of the talented multinational design and production team to find ways to realise the vision of the client and architect using advanced FRP composite materials. This project has made full use of Gurit's wide range of expertise in the technology of advanced FRP composite structures, including materials development, processing, testing and structural engineering, and I think that we can be proud of our contribution to this landmark project'.