

Basalt fiber as reinforcement material

Since 2008 basalt fibers are been produced in Sangerhausen, Germany. DBF Deutsche Basalt Faser GmbH has launched the first basalt manufacturing plant in the European union. Basalt stones with the grain size of approx. 40 mm are used for melting process. Stones are melted at the temperature of 1400°C with the patented technology of DBF GmbH and spinned to a continuous basalt fiber.

Reinforcement material in the concrete is under alkaline environment, especially in the beginning of concrete hardening (pH > 12). Reason for high alkalinity is to save steel reinforcement against corrosion during the carbonatization process. Carbon-

(pH 13,5 and 40°C).

The left figure 1 shows the basalt fiber in the alkaline solution at the beginning. Surface is undamaged. The structure of the surface does not change even after 360 days. Due to the aggressive alkaline areas calcite is growing on the surface but the basalt fiber surface is not attacked.

Additionally, to the alkaline tests, mechanical tests have been achieved on the fibre reinforced concrete samples. Concrete bars with the geometry 100 mm x100 mm x 400 mm had been tested on bending. So, called 3PB (3-point-bending) test results had been very promising.



Fig. 1: Basalt integral fiber in alkaline solution after 0 days (on the left) and after 360 days (on the right) (source: ifb TU Dresden)



Fig. 2: Three-point-bending of a concrete bar (source: ifb TU Dresden)

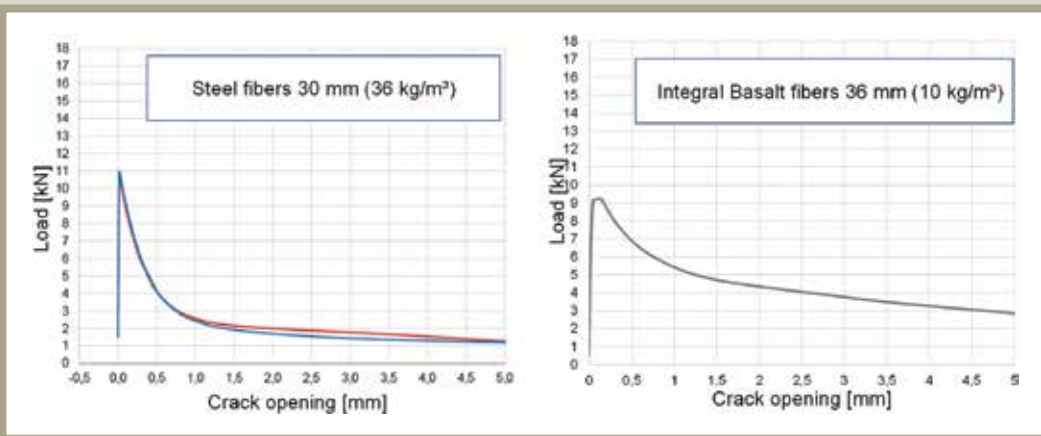


Fig. 3: Results of 3PB tests (Source: ifb TU Dresden)



Fig. 4: Basalt roving

atisation process do not affect mineral fibers in the concrete but the high alkalinity. High values of pH are measured especially in the first 28 days of the concrete life time.

Over last year's DBF GmbH has been actively working on development of basalt fiber applications for the construction industry. The state of art had shown, that basalt fibers without sizing and coating materials have poor durability in the alkaline environment. [S.Hempel, M. Butler, A. Younes, H. Michler; Verbundverhalten und Dauerhaftigkeit von Basaltfasern in alkalischen Matrices; TU Dresden; 2014]

So Company has dedicated to the development of sizing and coating materials in order to produce alkaline resistant basalt fiber. In cooperation with different German Institutes positive results has been achieved. Especially in cooperation with the Institute of construction materials of technical University of Dresden durability of modified basalt fiber has been proven after 360 days in constant aggressive alkaline environment

Higher loads were achieved with basalt reinforced concrete bars after progressing of crack opening compared to steel fiber reinforcement.

On the left figure 3 there is steel fiber reinforced (36kg/m³) bar and on the right image basalt fiber reinforced bar with only 10kg/m³. At the crack opening of 4 mm diagram on the left shows approx. 1,5 kN and basalt reinforced bar on the right approx. 3kN.

Based on this results company has been focusing on the applications for concrete reinforcement, such as reinforcement meshes, rebars and chopped fibers different of kind. Basalt fiber as reinforcement material is an ecological friendly and recyclable product for the construction industry with great economical value.



Fig. 5: Basalt integral fibers