

Effect of Pressure and Heat Treatments on the Compressive Strength of Reactive Powder Concrete

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Abstract. Reactive powder concrete (RPC) is categorised as ultra high performance concrete (UHPC) due to having compressive strength > 140 MPa. It can be developed by controlling three main variables: composition, pressure during setting period, and post-set heat curing. RPC has no coarse aggregate and contains a lot of fine particles (<600 µm) from silica fume, quartz sand and other admixtures. The treatments of pressure and heat during the curing period affects the strength of RPC and is mostly dependent upon three factors; the method of application, the temperature and duration of cure.

This paper presents the corresponding compressive strength of RPC with variables pressure combined with heating rate, heating duration, and starting time of heating. The treatments applied were 8 Mpa static pressure on fresh RPC prisms and heat curing at 240 °C in an oven. There were three different levels in every set; rates were 10, 50, and 100 °C/hour; durations were 12, 24, and 48 hours; and starting times were 1, 2, and 3 days. The compressive strength test was conducted at 7-d or 28-d using one part of the two broken pieces from the flexural test conforming to BS EN 196-1:2011 with the contact pressed area of the sample was 40 x 40 mm. The images of ITZ morphology were captured on surface of a fracture specimen by secondary electron detector mode using an SEM instrument to describe pore filling mechanism after treatments.

The results show that a heating rate at 50 °C/hr results in the highest compressive strength about 40 % more than these at 10 or 100 °C/hr; a heating duration of 48 hours lead to a maximum compressive strength compared to the samples at 12 and 24 hours; heat curing applied at 2 days after casting results in the maximum compressive. Heat curing had significant effect on compressive strength due to the acceleration of both reactions (hydration and pozzolanic) and the transformation of amount crystal from tobermorite to xonotlite. It is concluded that the optimum condition of treatments is both pressure and heat curing at 2-day after casting with a rate of 50 °C/hr for 48 hours.

Keywords: *compressive; crystal; heating; pressure; RPC; treatment; transformation.*

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