KLOKNER
INSTITUTE
CTU IN PRAGUE

Abstract

This doctoral thesis is focused on technology and material characteristics of a finegrained cement based composite material which is worldwide known as UHPC – Ultra High Performance Concrete. In the case of a matrix reinforced by fibres, this material is then known as UHPFRC – Ultra High Performance Fiber Reinforced Concrete. UHPC has the same matrix basic components (water, aggregates and cement) such as commonly used concretes. However, the mixture design of UHPC is much more complicated and it is based on high matrix density. High amount of cement, fine-grained aggregates (maximum grain size 4 mm), fillers and micro fillers (silica fume, slag, fly ash, etc.), using superplasticizers and low water to cement ratio are fundamentals for achieving high density of the matrix. A UHPC matrix is very dense and strong but very brittle. To achieve and increase a ductile behaviour after the first crack, the UHPC matrix is reinforced by a non-uniform reinforcing. The dispersion of the reinforcing has an essential impact on the material behaviour after the first crack and its homogeneity affects the load bearing capacity of UHPC. Therefore, the mixture design must be optimized for achieving a good stability of homogeneity of the dispersion reinforcing (steel fibres). An optical microscopic method appears to be a suitable and exact method for checking homogeneity of steel fibres. The steel fiber distribution is affected also by technological aspects. This thesis describes the technological aspects of the steel fiber distribution and their impact on load bearing capacity of elements made from UHPC. The possibility and production of functionally layered elements is also noted in this thesis.