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| Project Title: | The Effect of Maturity of Fiber Reinforced Cementitious Composites on Self-healing Performance |
| Project Coordinator: | Assist. Prof. Dr. Özlem KASAP KESKİN |
| Project Abstract: | Fiber reinforced cementitious composites (LDÇK) are the most important developments in building materials in recent years due to their ductile behavior under tensile loads, superior durability properties and the self-healing capabilities. Although their superior performances have been proven under laboratory studies, the practical usage of this material is still limited as the production requires high knowledge and experience and the initial cost is higher compared to the ordinary concrete. As LDÇK is a relatively new material, there is not much information and experience about their long-term behavior. Depending on the fact that the number of researches is inadequate, and it requires long time periods, it is aimed to determine the long-term behavior of materials by accelerated methods. During the aging of LDÇKs by accelerated methods, maturity concept which is applied on ordinary concrete for the on-site strength prediction, will be used. The maturity method is a non-destructive test method that measures the combined effect of time and temperature on concrete properties and based on the assumption that concretes having the same composition show similar properties at same maturity level. Within the scope of the project, the maturity parameters (datum temperature and apparent activation energy) of four different LDÇK mixtures will be determined by the method described in ASTM C 1074. The relationship between the maturity indices determined by using the Nurse-Saul and Arrhenius equivalent age maturity functions which are widely used in the literature and compressive and flexural strengths of the mixtures will be determined. At this stage, the best maturity function that represents the behavior of the material will be sought. By using the selected function, the temperature and curing durations at which the hydration of the samples will be completed for each mixture will be determined. Prepared cylinder and beam specimens will be cured in the determined manner so that they will reach their final strengths. After the strength values, deflection capacities and permeability properties of the specimens that has reached their final strength are determined, a group of samples will be preloaded and the self-healing capacities of the cracked samples will be examined. In order to determine the self-healing in the composites, compressive strength, flexural strength, mid-span deflection under bending, ultrasound wave velocity, rapid chloride ion penetration, resonance frequency values will be determined and compared with the results of sound specimens and the closure conditions of the cracks will be observed by crack microscope. In addition, self-healed cracked will be examined by Scanning Electron Microscope and characterization of self-healing products will done by X-Ray Diffraction. These studies will reveal the long-term properties of LDKÇs and the self-healing capacities of cracks occurred at later ages. In addition, 4 different LDÇK mixtures prepared in the early stages of the project will be kept in the laboratory for 1 year and then subjected to the same experiments. In the literature applications, tests are generally applied to 28 days old samples. However, the mixtures are expected to continue to acquire properties after 28 days since they contain very high amounts of binding materials. The project proposal includes the evaluation of 1-year old samples cured under standard conditions, along with the samples cured with the accelerated method. In addition, by using the accelerated method, some samples will be brought to the equivalent age of 1 year and the mechanical, permeability and self-healing properties will be investigated. Thus, accelerated cure results and normal cure results can be compared. The results from 1-year old samples will also be compared with the results obtained from 28-day old samples to determine how the behavior of LDCKs changes over time at long term. It is revealed from the literature studies that the deformability of LDÇK decreases as the strength increases. Hence, understanding the effect of matrix maturity on the properties of the material will be useful in predicting long-term behavior. The results of the proposed project will also allow the implementation of the maturity method for estimating the compressive strength of the LDÇKs in addition to revealing long-term mechanical, permeability and self-healing behavior of the LDÇKs. Moreover, among the different mixtures studied, the LDÇK mixture exhibiting better long-term performance will be determined. |
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