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Thesis for master s Degree << M.Sc >>

Comparison of the effects of nanomaterials on compressive strength and reliability of concrete containing Taftan volcanic ash in corrosive sulfate environment

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Abstract

Due to the increasing use of concrete as the most widely used building material, a lot of research is being done on its behavior all over the world. Increasing the quality and creating durability in concrete against destructive environments has forced concrete experts to use new materials as a substitute for cement such as pozzolans. Due to the high cost required for concrete admixtures, conducting experiments and research on indigenous admixtures seems to be cheaper and necessary. On the other hand, not paying attention to the mechanical characteristics and reliability or durability reduces the useful life of the structure and imposes economic costs for the repair and maintenance of concrete structures. In many cases, it is not possible to remove unfavorable environments and its effect on reducing the durability and service quality of reinforced concrete structures is inevitable. The construction of concrete structures in the coastal strip of Sistan and Baluchistan province has always faced sulfate attack. It is necessary to find a suitable and economic combination for making concrete using local materials in these areas, which has a good performance against sulfate attacks. Therefore, the use of volcanic ash available in Mount Taftan can be used as a suitable alternative to cement due to the softness of these particles, as well as economic and environmental efficiency. As the effort to increase the use of volcanic ash in cement replacement is growing, the focus of research towards the use of nanomaterials has increased. In this regard, in order to investigate the compressive strength and durability of concrete containing Taftan volcanic ash containing nano clay montmorillonite and nano calcium carbonate against sulfate attacks, in this study three different percentages (0.25%, 0.5% and 0.75%) of the nano materials mentioned in this research can be used as a part of cement replacement. For this purpose, 108 cylindrical concrete samples of 100 x 200 mm to perform compressive strength and electrical resistance test at the ages of 7, 28, 60 and 90 days and 54 cubic concrete samples of 100 x 100 x 100 mm to perform the capillary water absorption test of concrete at the age of 7 and 28 were made and placed in an environment containing ten percent magnesium sulfate and evaluated. The results indicate that in the compressive strength test, the design containing 0.5% montmorillonite nano clay with 0.25% nano calcium carbonate is 49.8% compared to the control design, and in the electrical resistance test, the design containing 0.75% montmorillonite nano clay Morillonite with 0.5% calcium nano carbonate increased by 36.11% compared to the control design, and in the capillary water absorption test, water absorption in the design containing 0.25% montmorillonite nano clay and 0.75% nano calcium carbonate showed the lowest water absorption. Compared to the witness plan, it was observed.

Key words: Taftan pozzolan, Mechanical properties, Concrete reliability, Sulfate environment, Montmorillonite Nano Clay, Calcium Carbonate Nano.