

Assessment of aggregates- cement paste border in concretes containing silica fume and fly ash

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ABSTRACT

The bond between aggregate and cement paste, called the interfacial transition zone (ITZ) is an important parameter that effect on the mechanical properties and durability of concrete. Transition zone microstructure and porosity (pores) of cement paste or concrete are affected by the type and properties of materials used which evaluated in this research. On the other hand, the use of efficient, low-cost and reliable method is particularly important for evaluating of concrete performance against the chloride ion penetration and its relationships with transition zone as a suitable index to assess the durability. So far, various methods to approach the electrical Indices are presented. In this research, the effect of pozzolanic materials fly ash (10%, 20% and 30%) and silica fume (5% and 10%) as substitute of cement by weight in binary and ternary mixtures on the fresh and hardened concrete properties were investigated. To determine mechanical properties, the compressive strength, splitting tensile strength and modulus of elasticity tests were performed. Also, water penetration depth, porosity, water sorptivity, specific electrical resistivity, rapid chloride penetration test (RCPT) and rapid chloride migration test (RCMT) tests were applied to evaluate concrete durability. To examine the border of aggregate and cement paste morphology of concrete specimens, scanning electron microscope images (SEM) was used. The fresh concrete results showed that the presence of silica fume in binary and ternary mixtures reduced workability and air content but fly ash increased them. Adding silica fume to mixtures of containing fly ash while increasing mechanical strength reduced the porosity and pores to 18%. The presence of pozzolanic materials in addition to increasing bond quality and uniformity of aggregate-cement matrix border a considerably positive effect on the transport properties of concrete.

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