Investigating Transport Properties of Low-Binder Ultrahigh-Performance Concretes: Binary and Ternary Blends of Nanosilica, Microsilica and Cement

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This study examined low-binder ultrahigh-performance concrete (UHPC) when nanosilica (NS) and/or microsilica (MS) were incorporated in Portland cement (PC) in either binary or ternary blends. Two groups were created for this purpose, and they were divided based on the presence or absence of silica flume (SF). NS was used as a restricted substitute for cement by weight at five different percentages (0%, 0.5%, 1%, 2% and 3%). The total binder was 800 kg/m3, and the ratio of water to binder was 1:5. Results demonstrated that optimum resistance to chloride permeability, gas permeability, sorptivity, water absorption and water penetration came from the 3% UHPC sample. The ternary blends of NS, PC and SF yielded better results than binary PC and NS blends. A 1% NS replacement gave similar effects to the UHPC properties investigated as a 10% MS replacement.