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SUSTAINABLE USE OF RECYCLED PLASTIC AND CERAMIC INDUSTRIAL WASTES IN ECO-FRIENDLY CONSTRUCTION MATERIALS

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Abstract

With the increasing consumption and shortage of conventional aggregates in construction products, as well as the growing problem of industrial wastes (IWs) accumulation and their landfilling, recycling and exploitation of IWs as alternative materials in concrete industry become the most suitable solution to ensure sustainable development in recent years. For more environmental, economic and technical benefits, this study investigates the feasibility of using plastic waste (PW) combined with ceramic waste (CW), as alternative aggregates in the elaboration of eco-friendly self-compacting concrete (SCC). For this, seven SCC mixtures were prepared at constant binder content of 473 kg/m^3 and water-to-binder ratio of 0.37. The sand and the gravel were substituted simultaneously with the CW and PW, respectively, at different dosages (0, 5, 10, 15, 20, 25 and 30% by weight). The obtained results showed that all workability measures are within the acceptable limit for SCC, as evidenced by the AFGC recommendation. The addition of CW as fine aggregate to PW based SCC contributes to compensating the performance loss caused by the PW, enhancing the properties of SCC, and therefore, not only contributes to reduce the level of waste and protecting natural resources, but would also enhance the physic-mechanical performance of SCC. Recycling up to 30% of PW and CW aggregates in SCC is considered feasible and much recommended for structural element applications in normal and moderate atmosphere since all the manufacturing SCC present satisfactory 28 days compressive and flexural strength, modulus of elasticity, ultrasonic pulse velocity and capillary water absorption (40 MPa; 9 MPs; 35 GPa; 4070 m/s and 5%, respectively). The thermal conductivity and bulk density decreased from 1.7 W/m.K and 2400 kg/m^3 for control SCC to 1.14 W/m.K and 1920 kg/m^3, respectively, for SCC with 30% CW and PW aggregates.

Key words: ceramic waste (CW), physic-mechanical performances, plastic waste (PW), self-compacting concrete, thermal conductivity

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