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Effect of Particle-Size Distribution and Specific Surface Area of Different Binder Systems on Packing Density and Flow Characteristics of Cement Paste

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Abstract

The particle-size distribution (PSD) and specific surface area (SSA) of binders significantly affect the fresh and hardened characteristics of cement-based materials. An experimental investigation was undertaken to evaluate the influence of PSD and calculated SSA of various binary and ternary binder systems on flow characteristics, packing density, and compressive strength development of cement paste. The influence of dispersion state of the binder on packing density was evaluated using the wet packing density approach to determine the optimum water demand (OWD) needed to achieve maximum wet density. The modified Andreasen and Andersen (A&A), Rosin–Rammler (RR), and power law grading models were employed to optimize the PSD of binder system to achieve maximum packing density, while maintaining relatively low water demand. The incorporation of high-range water reducing admixture (HRWRA) is shown to decrease the OWD and increase the packing density resulting from