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Swelling of Superabsorbent Poly(Sodium-Acrylate Acrylamide) Hydrogels and Influence of Chemical Structure on Internally Cured Mortar MATTHEW J. KRAFCIK, KENDRA A. ERK, Purdue University School of Materials Engineering — Superabsorbent hydrogel particles show promise as internal curing agents for high performance concrete (HPC). These gels can absorb and release large volumes of water and offer a solution to the problem of self-dessication in HPC. However, the gels are sensitive to ions naturally present in concrete. This research connects swelling behavior with gel-ion interactions to optimize hydrogel performance for internal curing, reducing the chance of early-age cracking and increasing the durability of HPC. Four different hydrogels of poly(sodium-acrylate acrylamide) are synthesized and characterized with swelling tests in different salt solutions. Depending on solution pH, ionic character, and gel composition, different swelling behaviors are observed. As weight percent of acrylic acid increases, gels demonstrate higher swelling ratios in reverse osmosis water, but showed substantially decreased swelling when aqueous cations are present. Additionally, in multivalent cation solutions, overshoot peaks are present, whereby the gels have a peak swelling ratio but then deswell. Multivalent cations interact with deprotonated carboxylic acid groups, constricting the gel and expelling water. Mortar containing hydrogels showed reduced autogenous shrinkage and increased relative humidity.

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