

2023 Della Roy Lecture

Hindsight, Foresight, and Insight: Calorimetry and Chemical Shrinkage through the Years Dale P. Bentz

Calorimetry and chemical shrinkage are perhaps two of the most straightforward measurements that can be performed on cement-based materials. As this lecture will illustrate, they are also two of the most informative. Following the seminal works of Powers and Carlson in the 1930's, these measures emerged from a 50-year near-hibernation in the 1980's and have proven invaluable in the ensuing years. The standardization of both measurements as ASTM test methods provided a foundation for their application to numerous concrete scenarios of practical interest. Through its linkage to autogenous shrinkage, chemical shrinkage has been applied as a fundamental test for understanding early-age cracking, debating optimal cement fineness, and popularizing internal curing into the mainstream. Calorimetry, both isothermal and semi-adiabatic, has proven equally versatile with its applications to basic hydration studies, quality assurance, optimizing sulfate content, troubleshooting cement/admixture interactions, and predicting strength development. These two measurements will continue to prove invaluable in the years to come in the emerging areas of 3-D printing, low carbon multi-component binders including current IL cements, and offshore wind applications.

Bio: Dale Bentz retired from the Engineering Laboratory at the National Institute of Standards and Technology in 2018 with 34 years of service. At NBS/NIST, his research focused on experimental and computer modeling studies of cement-based and fire resistive materials. He is a former chairperson of the ACerS Cements Division. Throughout his career, he was active in ACerS (Brunauer Award), ACI (Fellow, Wason Medal and Willson Award), ASTM (Honorary Membership in C01), and RILEM (L'Hermite Medalist). In 2019, he was inducted into the NIST Portrait Gallery of Distinguished Alumni.

