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TechNote

Significance of the Shrinkage-Compensating and Nonshrink Labels on Packaged Repair Materials

Keywords: cracking; expansion; nonshrink; packaged; prestress; repair material; restraint; shrinkage-compensating; tensile stress.

Question

What does it mean when a packaged repair material is labeled as shrinkage-compensating or nonshrink?

Answer

The terms 'shrinkage-compensating' and 'nonshrink' are both intended to describe materials that exhibit no or little net contraction as a result of shrinkage. In practice, however, these terms are of limited use in the selection of repair materials without supporting test data on time-dependent volume changes.

Discussion

Many proprietary repair materials are described as shrinkage-compensating or nonshrink. In most cases, the manufacturer's data sheets do not explain the meaning of such terms. Given the restraint conditions typically provided by the concrete substrate, accurate expansion and shrinkage data are essential for selection of shrinkage-compensating or nonshrink materials that will provide durable repairs. This Technote provides clarifications on the actual significance of the labels 'shrinkage-compensating' or 'nonshrink' found in technical data sheets.

Moisture loss is unavoidable in cement-based materials as soon as they are exposed to a relative humidity less than 100 percent. This moisture loss results in drying shrinkage and volume changes within the material. In addition to shrinkage that occurs due to drying, the hydration reactions will cause some unavoidable chemical shrinkage. Consequently, significant efforts have been made to counteract shrinkage and its undesirable effects, such as tensile stresses and cracking. Expansive cements were first introduced more than half a century ago to produce so-called shrinkage-compensating concretes. Shrinkage-compensating is defined by the ACI CT as:

> A characteristic of grout, mortar, or concrete made using an expansive cement in which volume increases after setting and, if properly elastically restrained, induces compressive stresses which are intended to approximately offset the tendency of drying shrinkage to induce tensile stresses.

In these materials, a chemical agent added to the cement reacts during curing to produce an expansive compound, resulting in a net volume increase of the material. The dosage of expansive agent has to be selected such that the initial expansion will offset subsequent shrinkage, as depicted in Fig. 1.

The shrinkage-compensation process for repair materials is similar to that for shrinkage-compensating concretes. The latter are often made with Type K cement (ASTM C845/C845M) and sometimes with the use of other types of expansive agents added during the mixing operations, generally calcium sulfoaluminate-

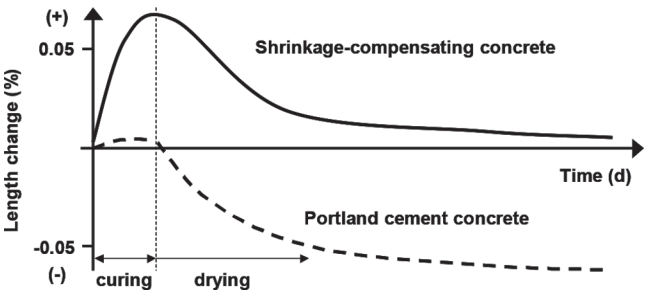

Fig. 1—Typical length change behavior of shrinkage-compensating and portland cement concretes (adapted from ACI 223R).