Kinetics comparison of alkali-reactivity tests for aggregates

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Abstract. Among the test-methods for evaluation of aggregates reactivity towards alkali-silica reaction (ASR), linear dilatation of mortar bars or concrete prisms is often used in several tests under various conditions, criteria and procedures of measuring and accelerating the reaction. As reactivity is an essentially kinetic property, the expansion limits in such tests, or even tests results for the same aggregate, should be kinetically inter-related.

This paper presents a proposal of a kinetic relationship for critical reaction rates, evaluated from criteria of standard test-methods NF P 18-590, ASTM C 1260 and ASTM C 1293. To do so, the critical expansion rate of these tests were corrected for a reference 1M alkalinity and depicted as Arrhenius plot. The high correlation of the regression line shows linearity of the plotted data, which was assumed as a criterion of kinetic compatibility between the said tests.

The discussion includes a comparison with other tests and literature comments on their evaluation.

The main interest of this study concerning the potential for ASR, is to discuss and compare methods aiming to improve the service life of concrete structures, by:

   i) selection of good materials;
   ii) decisions on the appropriate concrete formulation;
   iii) foreseeing possible problems allowing to plan monitoring and/or the need for adequate intervention as well as the possibility of test improvements.

The extension of service life allows savings in raw materials and energy, improvement of the investment economics and, in the long term, lower investment requirements.

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