Corrosion rate of steel in carbonated concrete made with modern binders

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To achieve practical, cost-effective solutions with materials having a reduced environmental footprint, cement industry substituted clinker (responsible for great part of the CO_2 emissions) with supplementary cementitious materials (SCM) such as limestone, fly-ash, burnt oil shale etc. in a complex blend (see e.g. European Cement Standards EN 197-1). The long-term durability of the final product concrete made with these modern binders is far less established: due to the reduced clinker content, the pH of the concrete pore solution is lower, the alkali reserve is reduced and questions arise regarding the corrosion protection of the steel. The rate of carbonation process is much faster at least for some of the modern binders and carbonation becomes a durability issue.

One approach to achieve the required long service life also with modern binders would be to include also part of the propagation period – thus the corrosion rate of steel in carbonated concrete becomes of outmost importance. In this work an experimental approach using thin samples made of cement paste and mortar with different modern binders is presented. In completely carbonated samples resistivity, oxygen diffusion and corrosion rate can be measured as a function of composition, exposure condition (relative humidity) and time. The first results of an ongoing research work are presented.