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Reducing CO_2-Emission by using Eco-Cements

K. Voit (1), K. Bergmeister (1), and I. Janotka (2)
(1) Austria (klaus.voit@boku.ac.at), (2) Slovakia

CO_2 concentration in the air is rising constantly. Globally, cement companies are emitting nearly two billion tonnes/year of CO_2 (or around 6 to 7 % of the planet's total CO_2 emissions) by producing portland cement clinker. At this pace, by 2025 the cement industry will be emitting CO_2 at a rate of 3.5 billion tones/year causing enormous environmental damage (Shi et al., 2011; Janotka et al., 2012).

At the dawn of the industrial revolution in the mid-eighteenth century the concentration of CO_2 was at a level of ca. 280 ppm. 200 years later at the time of World War II the CO_2 level had risen to 310 ppm what results in a rate of increase of 0,15 ppm per year for that period (Shi et al., 2011). In November 2011 the CO_2 concentration reached a value of 391 ppm (NOAA Earth System Research Laboratory, 2011), a rise of ca. 81 ppm in 66 years and an increased rate of around 1,2 ppm/year respectively. In the same period cement production in tons of cement has multiplied by a factor of ca. 62 (Kelly & Oss, US Geological Survey, 2010).

Thus new CO_2-saving eco-cement types are gaining in importance. In these cement types the energy-consuming portland cement clinker is partially replaced by latent hydraulic additives such as blast furnace slag, fly ash or zeolite. These hydraulic additives do not need to be fired in the rotary furnace. They ony need to be pulverized to the required grain size and added to the ground portland cement clinker. Hence energy is saved by skipping the engery-consuming firing process, in addition there is no CO_2-degassing as there is in the case of lime burning.

Therefore a research project between Austria and Slovakia, funded by the EU (Project ENVIZEO), was initiated in 2010. The main goal of this project is to develop new CEM V eco-types of cements and certificate them for common usage. CEM V is a portland clinker saving cement kind that allows the reduction of clinker to a proportion of 40-64% for CEM V/A and 20-39% for CEM V/B respectively by the input of slag sands, puzzolanes and fly ash (according to standard EN 197-1).

In this context four new CEM V kinds have been created, two Austrian types based on slag and fly ash, and two Slovak types, one based on slag and fly ash, the other on slag and natural pozzolana. The pozzolana consist of zeolite of clinoptilolite type that is gained from a Slovak deposit.