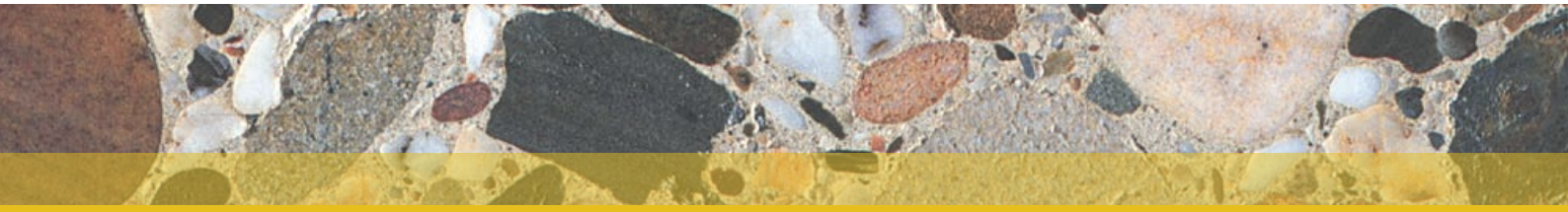
ecra

european cement research academy



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NEWSLETTER

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Next ECRA events:

- Conference “New Cements and Innovative Binder Technologies”
  5 May 2011

REGISTER NOW!

- Current Developments in Continuous Emission Monitoring
  18–19 May 2011
- Cement Grinding Technologies
  29–30 June 2011

ECRA in 2011 / Conference in Barcelona

ECRA's programme begins with a conference on new cements and innovative binder technologies

For eight years now, ECRA has been offering seminars and workshops providing sound technical and scientific information on cement production and its application in mortar and concrete. This year, the Academy will kick off its programme of events with a spring conference titled "New Cements and Innovative Binder Technologies" which will take place on 4–5 May in Barcelona, one of Europe's most spectacular and beautiful cities.

Cement will remain the key material to satisfy people's needs with respect to housing and modern infrastructure. Consequently, the cement industry worldwide is facing growing challenges in the context of saving material and energy resources as well as reducing its CO_2 emissions.

The ECRA Conference will provide a state of the art overview of the current status of research on these new cements and their performance in concrete and mortar. Different approaches will be reported, all of which have in common that they supposedly emit less CO_2 in their production than today's Portland cements.

Such cements are still under research and development as regards their production and their performance in concrete. They are either not based on limestone as a starting material or exhibit a ratio of calcium to silica which is lower than in today's cement. Both approaches would result in a good CO_2 balance. At the same time the question still remains open as to which degree these new cements can technically replace common, well tried and proven ones in the medium and long term.

Distinguished speakers

The conference will be of particular interest to sales, marketing and consulting engineers, and also R&D staff. The speakers invited are outstanding experts in their fields who will not only present their topics but also be available for technical discussion in the course of the conference.

Presentations include:

- Novacem – a carbon negative cement for the construction industry (Nikolaos Vlasopoulos, Novacem)
- Calera – CO_2 embodied carbonate cement materials (Tom Carter/Marty Devenney, Calera)
- Celitement – a new CSH binder beside Portland cement (Hendrik Möller, SCHWENK Zement KG)
- Sulphoaluminate cement – recent developments (Günther Walenta/Cedric Comparet, Lafarge)
- Alumina-rich glass cement (Albrecht Wolter, TU Clausthal)
- Development of cements based on current cement standards:
  - Ternary binder systems
  - Calcined clays – a potential cement constituent (Simone Schulze, VDZ)

Visit to Cementos Molins

The conference commences with a special highlight on 4 May 2011, when Cementos Molins will be opening its doors to welcome all conference participants to a tour of the cement plant in Sant Vicenç dels Horts. Before the tour there will be an informal welcome reception in the foyer of the Hilton Barcelona Hotel which will give the participants a good opportunity to get to know each other. The conference continues on 5 May from 09:00 till 16:00 at the hotel.

All those interested are invited to take part. The participation fee for participants from ECRA member companies/organisations is 950 EUR per person with a discount of 25 % for each additional participant from the same address. Registration is possible until 17 April 2011 via the ECRA website.

Training course for young engineers

In 2011 ECRA will for the first time hold a training course for young engineers. Taking place in Duesseldorf in November, the course will cover in depth over two days all the basic aspects of cement production with special focus on technical, chemical and environmental issues. The participants will obtain a deeper understanding of the entire production chain, from raw material preparation to cement grinding and cement performance in concrete.

ECRA's programme for 2011 also includes five other seminars. For further information on all events and registration please visit the ECRA website at www.ecra-online.org.

Guell Park in colourful Barcelona

Cementos Molins

The Sagrada Familia

Latest developments in continuous emission monitoring

First experiences with a new generation of mercury CEMs and quasi-continuous PCDD/PCDF samplers

The continuous monitoring of the emissions of cement kilns is a matter of growing concern for the European cement industry. Particularly when waste fuels are burnt, plant operators have to meet the stringent requirements of the European Directive 2000/76/EC on the incineration of waste. A major example in this context is the continuous monitoring of mercury which was discussed intensively during the last revision of the cement and lime BREF document. There are still unsolved issues concerning the proper and safe practical application of these devices. Currently, different suppliers are bringing new developments onto the market which are a matter of ongoing interest. In contrast, a relatively new topic for the cement industry is the quasi-continuous sampling of PCDD/PCDF emissions. First devices have been installed within the cement industry. However, the actual advantage of these devices is still questionable. Nevertheless, as this approach is increasingly becoming a focal point, also with respect to regulators, the pros and cons of such quasi-continuous sampling deserve closer consideration.

Based upon the European Directive on the Incineration of Waste (Directive 2000/76/EC), the mercury emissions of cement kilns burning alternative fuels have to be monitored periodically. This procedure has to be carried out according to the European Standard EN 13211. In some European countries (e.g. Austria, Germany) the continuous monitoring of mercury emissions has been mandatory by law for some years for cement kilns using alternative fuels. From the very beginning, however, there have been problems regarding the application of the commercially available mercury CEMs. Because of this, the continuous monitoring of mercury is not yet fixed as a best available technique (BAT) in the revised Reference Document on Best Available Techniques (BREF-Document).

Specific challenges of mercury measurement

Mercury is introduced to the clinker burning process via the raw materials and the fuels. Due to its high volatility, mercury is retained in the kiln system only to a lesser extent. Moreover, it should be pointed out that mercury can react with other elements in the kiln/preheater zone to different compounds. Besides elemental mercury (Hg0), a lot of other reaction products like $HgCl_2$, HgO, HgS, $HgBr_2$ or $HgNO_3$ may be formed.

Basically, all monitoring devices apply the same analytical technique which is based upon cold vapour photometry. The complete reduction of all mercury compounds before the actual analysis is one of the crucial points in the application of the CEMs. Practical experience has shown that many additional maintenance steps have had to be carried out. Additionally, it was necessary in many cases to modify the commercially available devices to make them suitable for individual application. Based upon these experiences, new mercury CEMs have been developed which are currently being brought onto the market by different suppliers. However, long-term experience with these devices is still lacking.

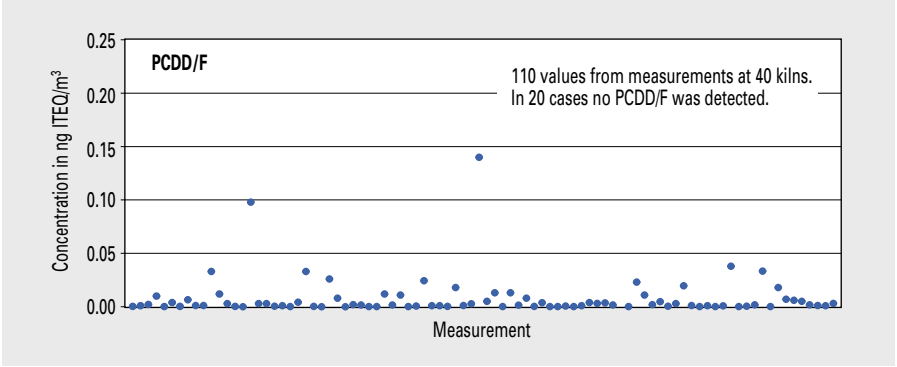

Fig. 1: PCDD/PCDF concentrations measured at 40 kilns in 2009.

Quasi-continuous measurement of PCDD/PCDF

The measurements of dioxins and furans have to be in line with the European Standard EN 1948 which requires a measuring period of six to eight hours. For some time quasi-continuous measurement principles have been available on the market which allow long-term measurements of dioxins and furans. In principle, these sampling systems fulfil the requirements of EN 1948. The measurement period may be extended to four to eight weeks. Depending on the purpose, weekly, bi-weekly or monthly mean values may be generated. Nevertheless, the actual additional value of such a long-term sampling period is still questionable. It is well known and generally accepted that cement kilns as such do not deliver any major contribution to industrial dioxin emissions. **Figure 1** depicts the PCDD/PCDF concentrations measured at 40 kilns in the year 2009.

From this point of view, the duration of measurements as it is fixed in the European standard EN 1948 (6 to 8 hours) should be sufficient for a reliable assessment of the actual dioxin emissions of the respective plant. Moreover, these periodic measurements have to be carried out two to three times per year based upon the European waste incineration directive and its actual implementation into the national law of the different European member states.

Furthermore, it has to be pointed out that a longer measurement period might even lead to a certain smoothening of peaks which could be observed during the normal periodic measurements. On the other hand, the long-term sampling procedure offers an additional way for plant operators to prove that dioxin emissions are at a low level over a longer period.

Current grinding technologies in cement production

Grinding techniques used in cement production differ considerably

Comminution processes are basic steps in the production of cement. More than 60 % of the electrical energy demand is required for the crushing and grinding of raw material, cement clinker and fuels such as coal and petcoke. About two thirds of this energy is spent on cement grinding. The energy-intensive grinding processes have a significant influence on production costs. The cement grinding also has a direct impact on the quality of the manufactured product. Both with regard to the demand for cost-efficient production and obtaining the highest possible cement quality, the selection of the appropriate grinding technique is an extremely important issue.

For the grinding processes in cement manufacture several techniques are in use today which have been developed over the years. The oldest of the industrially used grinding technologies is the ball mill, which has been used since the 19th Century. The major reason for adhering to this grinding technology for such a long time is its well known robustness and reliability. With the ball mill it is possible to produce a wide particle size distribution (PSD), which is necessary for good workability of the cement, since the water demand of such cement is low. A disadvantage of the ball mill is the relatively high specific energy demand per ton of product. Theoretically, less than 5 % of the electrical energy is converted into grinding work. The rest is lost, particularly in the form of heat. Nevertheless, worldwide more than 50 % of grinding plants for cement production are equipped with ball mills, because the positive effects of this comminution technology more than compensate for the disadvantage of the high energy consumption.

Another proven technique for grinding processes in cement manufacture is the vertical roller mill (VRM) (**Fig. 1**). From the first half of the 20th Century this technique has been continually improved. The VRM was initially used mainly for raw meal grinding because of the very good drying capacity. The most important criterion for this development is the specific energy demand, which is up to 40 % lower compared to that of a ball mill. Furthermore, in the 1990s high pressure grinding rolls (HPGR) were developed, which, like the VRM, feature much lower specific energy consumption for grinding, but at the same time have an even stronger impact on PSD. HPGR are therefore almost exclusively used in combination with ball mills for the final adaption of the PSD.

Another type of mill which has also been used in the cement industry for about 20 years is the horizontal roller mill. With respect to the specific energy demand and the product quality, the characteristics of this mill type are similar to those of the roller press.

Cement quality and reliability

The importance of energy-efficient grinding systems like the VRM or HPGR for cement grinding is becoming more and more evident. But product quality on the one hand and operation reliability involving issues such as control techniques and maintenance on the other hand are also important challenges which influence the cement producer's decision for a particular grinding system. Particle breakage inside a bed of material under high pressure differs significantly from comminution during ball-to-ball contacts. PSD, the form of particles and the fracture properties of material processed in ball mills (**Fig. 2**) and high pressure grinding systems therefore exhibit some important differences. The effects on the final product concrete in conjunction with market demands strongly affect the choice of grinding systems and therefore lead to different predominant mill types in the various regional markets.

In addition, operational reliability, especially stable operation with regard to vibrations and the wear on the rollers, has been one of the main issues among all high pressure grinding systems. New drive designs and roller layouts have improved process stability and reduced maintenance complexity. Latest developments even include modular drive systems which allow the maintenance of rollers and drive during operation.

Future prospects

Grinding systems are undergoing continual development. In the future a further increase in the number of installed high pressure grinding systems is generally expected due to their efficiency. Because of high investment costs the replacement of existing ball mills is still not cost effective in many cases. The optimisation of installed ball mills therefore also holds large potential.

Fig. 1: Vertical roller mills are commonly used for raw material grinding due to their very good drying capacity.

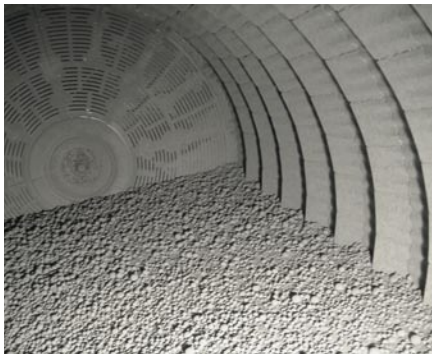

Fig. 2: Because of their reliability, ball mills still account for the majority of installed mills.

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