Welcome

by Mark Tyrer, Chairman of Cementitious Materials Group

This is the third edition of the IOM3 Cementitious Materials Group newsletter and I am pleased to be able to pass on thanks to all the correspondents who have contacted us recently. We welcome all contributions, from one-line emails for the What’s On / Events listings to more substantial letters, or suggestions of things we might organise on behalf of the readers.

The annual conference (33rd CCS meeting at Portsmouth, September 2013) was a great success and we were pleased to honour Dr. Bob Viles (Fosroc) who gave the Mellor Memorial Lecture. There is a more complete report of this and the meeting as a whole in Materials World (v21-11 November 2013, p.61) and the event was a great success and well attended, with almost 100 delegates (See: http://www.port.ac.uk/departments/academic/sces/ccs2013/). In the spring, we will be pleased to support the one day Young Researchers’ Forum to be hosted at UCL on the 19th February (see: http://www.ucl.ac.uk/aim/conference-progress-meeting-yrf). This is very much a work-in-progress meeting for university researchers and new appointees to industry and is an opportunity to speak to a friendly audience of your peers. The meeting is particularly a low-cost event and is intended to be a forum on which new researchers will have the opportunity to meet colleagues in related fields. Unusually, the meeting is promoted by several institutions spanning construction materials in its widest sense, and is promoted by all of them. Please attend if you can, as it promises to be an interesting day.

Our next major conference will be the 34th Cement and Concrete Science Symposium, hosted by the University of Sheffield on the 14th-16th September 2014 (See: http://www.shef.ac.uk/materials/ccs2014). The call for abstracts is open now and it is likely that this will run concurrently with a meeting specifically on cements in waste management. Soon after the CCS meeting, will be the IOM3 Hume-Rothery Seminar. This is organised by our sister IOM3 committee, the Materials Chemistry Group and will be a workshop on applied thermodynamics and phase diagrams. This is aimed particularly at researchers who are new to these fields and will be presented by leaders in the subject. It is intended to encourage new users through training sessions and tutorials. More details will be published on line soon (http://www.iom3.org/content/materials-chemistry).

Finally, if there is a topic which you think might be suitable for a meeting, or you would welcome another event, such as training or a site visit, please drop a line to: cmg.iom3.newsletter@gmail.com

Wishing all a very Happy Christmas!

Mark Tyrer
Restrictions to be put on overproducing industries in China

The cement industry is one of China’s key industrial sectors that will face strict governmental limitations on its production output. Other industries include iron, steel, aluminium, and coal. State targets include restricting the scale of production, establishing systems to alert the authorities of excess production and improving the structure of manufacturing. Furthermore, there are plans to limit refinancing and investment in these sectors.

As part of the government’s plan, Chinese companies will be assisted in attempts to expand abroad in order to widen consumer markets and reduce excess capacity. The cement industry has already proceeded with this, with many companies asking for assistance in expanding and finding investment overseas.

Read more about China’s measures to reduce overcapacity in industry here.

Edited from various sources by Rosalie Starling

World cement 14/11/2013

Journal of Sustainable Cement-Based Materials, launched in 2012 and published by Taylor & Francis Group, aims to publish theoretical and applied research on materials, products and structures that incorporate cement. It is a forum for discussion of research on manufacture, hydration and performance of cement-based materials; novel experimental techniques; the latest analytical and modeling methods; the examination and the diagnosis of real cement and concrete structures; and the potential for improved cement-based materials.

The Journal welcomes original research papers, major reviews, rapid communications and selected conference papers. It covers a wide range of topics within its subject category, including but are not limited to:

- raw materials and manufacture of cement
- mixing, rheology and hydration
- admixtures
- structural characteristics and performance of cement-based materials
- characterization techniques and modeling
- use of fiber in cement based-materials
- degradation and repair of cement-based materials
- novel testing techniques and applications
- waste management

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The Journal has an Editorial Board of cement and concrete materials of International reputation. You are invited to submit your manuscript(s) to the Journal online. It will sent to at least two experts in the area for review. We promise a fast and fair review. For further information about the journal and submission of your manuscripts, please visit http://www.tandfonline.com/TSCM
Message from the Mineralogical Society

Congratulations to the editors of the CMG Newsletter. It's a great read. Keep up the good work.

Characterization of materials, natural and otherwise, is a keystone of what materials scientists and mineralogists (in a broad sense) do. At the end of the recent 'Minerals for Life' conference (held in Edinburgh this past summer - see the report at http://www.minersoc.org/minerals-for-life.html), a delegate from industry gave us mineralogists a significant take-away message. He said words to the effect "I've been hugely impressed with the methods mineralogists use to characterize materials, natural and otherwise. Materials scientists and others have much to learn from them." Clearly the same techniques are available to all, but hearing about how mineralogists adapt these techniques to materials which are often heterogeneous can be very instructive.

The Mineralogical Society's Clay Minerals Group (another CMG) has supported the last couple of Cementitious Materials Group meetings. Maybe we could extend this relationship? I'd be happy to hear from people in the IOM-CMG who might be interested in another joint event, one which draws more on the skills of mineralogists and makes them available to those of your industry. We could also provide information about relevant publications for your digest of the literature given at the end of each of your Newsletters. Email me at kevin@minersoc.org

Kevin Murphy
Executive Director, Mineralogical Society

Lafarge Malaysia signs MoU to increase construction skills and standards

Lafarge Cement Sdn Bhd, a wholly owned subsidiary of Lafarge Malaysia Berhad, has signed a Memorandum of Understanding with CIDB Holdings Sdn Bhd, a subsidiary of the Construction Industry Development Board Malaysia (CIDB). The MoU aims to improve construction standards and sustainable construction practices in Malaysia through enhanced training and skills development. The two companies will work together to provide training and certification to construction workers, sharing their knowledge and expertise in the use of cement and concrete, as well as innovative sustainable construction practices.

The MoU is in line with Lafarge’s “Building Better Cities” global initiative. It will utilise the building material producer’s research and development capabilities both internationally and locally, such as the Construction Development Lab in Petaling Jaya.

“At a time where Malaysia is moving closer towards its goal of becoming a high-income, developed nation, the pursuit of sustainable development is crucial now more than ever. Our partnership with CIDB is a testament to our commitment towards driving sustainable development in Malaysia and ‘Building Better Cities’ through elevating construction standards,” commented Bradley Mulroney, President and CEO of Lafarge.

“CIDB aims to support the development of a world class construction industry as Malaysia plays a more significant role in the global economy on the back of its development into a high-income nation. With the construction industry expected to continue on a growth trajectory going into 2014, our partnership with Lafarge aims to support the industry and in particular, to develop a steady stream of trained construction personnel skilled in the use of concrete and cement materials,” added Dato’ Sri Ir. Dr. Judin Abdul Karim, CEO of CIDB Malaysia and Chairman of CIDB Holdings Sdn Bhd.

Adapted from press release by Louise Fordham
Published on 27/11/2013
UV powered pathway to save on UK energy bills

Using pioneering re-surfacing methodology, Pro-Teq Surfacing UK Ltd has developed a solution to high local and national government energy bills: STARPATH, the energy efficient alternative to street lighting.

Following an extensive period of chemical trials, the surfacing company has developed and patented a world first for spraying a liquid based product in combination with either soft or hard media. The new technology is currently being trialled in Christ’s Pieces park, Cambridge. The pathway measures 150 square metres, took 30 minutes to spray the material on, and the surface was ready for use less than four hours after the job commenced. One of the key advantages of STARPATH is its cost-effectiveness, being cheap to both install and maintain. Furthermore the product may be applied to any existing solid surface, including concrete, tarmac and timber. The aggregate material absorbs energy from UV rays during the day, which is then released at night, allowing the particles to glow.

The surfacing solution has considerable environmental appeal beyond the reduction in council energy bills. It eliminates the substantial cost of removal and disposal of the existing surface, reducing the council carbon footprint. It is a sustainable surface, perfect for cyclist and disabled access and has a high safety margin with its anti-slip properties. The aggregate is additionally a non-reflective light source, the lack of any glare off the surface further enhances its acceptance in more populated residential areas.

Hamish Scott, Owner of Pro-Teq Surfacing UK Ltd stated, “This product adjusts to the natural light, so if it is pitch black outside the luminous natural earth enhances, and if the sky is lighter, it won’t release as much luminosity – it adjusts accordingly, its almost like it has a mind of its own.”

Pro-Teq’s website further details how its re-surfacing solution works, and the technology behind it.


Chinese cement companies back on track due to an increase in construction

China has seen an increase in infrastructure and building projects in the east and south of the country. The eastern Jiangsu and Zhejiang and southern Guangdong provinces are experiencing widespread construction in a bid to resolve the areas’ problems with overcrowding and cement companies are set to benefit from this. Low coal prices have also led to increased production.

Major cement companies, such as Anhui Conch Cement Co Ltd and Asia Cement China Holdings Corp, reported a decrease in profits in 2012, however earnings and profit growth have risen this year with many cement firms announcing strong results and there are predictions of further increases in the coming year.

Financial results

- Anhui Conch announced a 37% y/y increase to RMB5.38 billion, compared to 4.3% growth in the first half and a 45% fall in earnings in 2012.
- Asia Cement reported a 166% jump in net profit from January to September to RMB391 million.
- Huaxin Cement’s earnings rose 131% to RMB558 million.
- Gansu Qilianshan Cement Group Co Ltd saw an increase of 118.5% in net profit to RMB365.32 million during the period.

However industry insiders note that this progress could be impeded in the coming months by factors such as a decrease of investments in railways and a slowdown in the property market.

Third quarter cement producers roundup

The third quarter results are in and signs of a recovery in the construction industry are present. Generally for the European producers, volumes of cement sold in the third quarter of 2013 have improved year-on-year compared to the figures for the first nine months of 2013. Although many of these third quarter sales changes are still negative it seems like the industry has turned a corner.

Lafarge reported that cement sales fell by 4% year-on-year to 102Mt for the first nine months in 2013. In the third quarter of 2013 sales remained stable year-on-year at 36.7Mt. Holcim saw its nine month sales fall by 3% to 104Mt while its third quarter sales remained stable at 36Mt. HeidelbergCement saw its nine month sales rise by 1% to 67.7Mt while its third quarter sales rose by 4% to 25.3Mt. Italcementi saw its nine month sales fall by 6% to 32.6Mt while its third quarter sales fell by 2% to 10.8Mt.

By region some of the differences between the European-based multinational cement producers have been telling. Lafarge, for example, is still down year-on-year on cement volumes sold in North America, denting the perceived wisdom of a strong North American recovery. However, profit indicators such as earnings before interest, taxes, depreciation and amortisation (EBITDA) have risen in that region, increasingly in the third quarter. Cemex and Holcim have done better in this region.

Notably, the unstable political situation in Egypt has also impacted the balance sheets for Lafarge and Italcementi. Lafarge reported that cement sales volumes fell by 27% for the first nine months of 2013, principally due to gas shortages, and 19% for the third quarter as the company started to substitute other fuels. Similarly, Italcementi saw overall cement and clinker sales drop by 11.2% in the nine months and 14% in the third quarter.

Meanwhile in China, Anhui Conch produced 86.2Mt for the nine months, a year-on-year increase of 12.1%. Overall revenues in China seem to have risen after decreases in 2012. Anhui Conch reported that its operating revenue rose by 15% to US$6.08bn for the first nine months and US$2.20bn for the third quarter of 2013. Analysts have pinned the return to profit to building in the country's eastern and southern provinces and the effects of government-led industry consolidation. Bucking this trend though, China National Building Materials (CNBM) saw its revenue rise by 37% to US$13.5bn for the first nine months of 2013 but its profit fell by 8.1% to US$542m.

Anhui Conch, Lafarge, Holcim, CNBM, Italcementi and HeidelbergCement all feature at the top of Global Cement's list of the 'Top 75 global cement companies' to be published in the December 2013 issue of Global Cement Magazine. Ahead of final publication we want to know whether readers agree with the rankings.

Construction output booming in the UK

The construction industry in Britain has witnessed a boost in business as the economic outlook improves, growing by 0.8% in 3Q13. This was fuelled by new housing projects and development in the commercial and engineering sectors. Furthermore, a better outlook for the UK economy has caused an increase in spending on building projects. Construction companies have had their highest employment rate for new workers in six years in anticipation of increased construction work. The government is also behind the increase in construction activity and encouragement of investment in property, with the setting up of the Help to Buy scheme for first time buyers.

Award winner

Figures for UK construction industry

- The output measure for the Markit/CIPS UK Construction PMI was 59.4 at the beginning of the month, compared to 58.9 in September 2013. This is the highest it has been since the same period in 2007.
- The beginning of 3Q13 showed a 2.5% increase in construction output and this activity is predicted to continue throughout the quarter.
- The output of construction increased by 5.8% y/y. Over the same period new housing showed growth of 13.6%. However, m/m construction output saw a decrease of 0.9%.

GB cement sales

- Domestic cement sales have risen from 646 000 t in September 2012 to 748 000 t in September 2013.
- Clinker production has increased from 545 000 t in September 2012 to 613 000 in September 2013.

However, the state of the economy is not certain. Although the construction industry is booming, the industry only accounts for 6.3% of national output. Despite this, there remains hope that the construction sector will help the economy to see further GDP growth in 4Q13.
Tunnel Engineer - Sprayed Concrete Lined (SCL)

Job Type: Contract/Temp
Location: London
Start Date: ASAP - Urgent Requirement
Duration: 12 month FTC
Salary: £260 - £280 per shift

Are you a Sprayed Concrete Lined Tunnels Engineer? Looking for a new contract? I have a 12 month Fixed term Contract available for a Tunnel Engineer with proven experience in Sprayed Concrete Lined Tunnels.

You will be working on a Crossrail project, with an immediate start for the right candidate. Ideally you will be degree qualified with established experience in Sprayed Concrete Lining, site based. Preferably chartered or working towards chartership with ICE or any other recognised institutions. You will be responsible for the detailed Sprayed Concrete Lining activities on site at one of the Sprayed Concrete Lined stations or shafts. This will include the responsibility for monitoring the performance of the primary lining against the ground conditions encountered.

You will also offer support to the Sprayed Concrete Lined Tunnels Inspector on shift with inspections, carrying out regular inspections of all Sprayed Concrete Lined activities. Reviewing SCL submissions from contractors, including method statements and technical requests.

The works carried out will be around the clock, 24-hour. You will be expected to work shifts on a 21-day pattern, e.g. - 7 days on, 3 days off, 7 days on, 4 days off.

Calco apologise that we cannot respond to all applicants personally and only those who match the criteria of the client will be contacted.

Calco Services operates as both an employment business and agency. If your application is for a position based in the UK or EU, under European Employment Law you MUST be eligible to live and work there.

Application through following website:

Jobs with Hanson

Hanson Cement is a major producer of cement and ground granulated blast furnace slag (GGBS), a cement replacement in ready-mixed and precast concrete. We are part of Hanson UK, a leading supplier of heavy construction materials and a division of Heidelberg Cement Group.

Technical Production Officer

We have a vacancy for a Technical Production Officer to cover a number of Concrete & mortar units in the Central East Area. Ideally based in the Cambridge or surrounding area the successful candidate will be responsible for the quality management of 21 concrete plants across the Northampton, Cambridgeshire, Essex and Suffolk regions.

A sound technical knowledge of Concrete & mortar is required and ideally the successful candidate will have held a similar or supporting role in the industry. Possession of City & Guilds Concrete Technology Parts 1 and 2 or equivalent is desirable.

Location: Needingworth
Closing Date: 24/12/13
Hiring Manager: Birkinshaw, Adam
Hiring Manager Contact Number: 07799 656309

Field Technician

We have an opportunity for a Field Technician to provide technical cover at our plants in the Somerset area. Duties will include the sampling and testing of aggregate & asphalt in the field, laboratory work and the recording and analysis of results in a QA environment.

You must be a self-motivated, organised and enthusiastic individual with a genuine willingness to learn in this field. Previous experience would be advantageous, however, full training will be given. A full UK driving licence is essential and the successful applicant should be willing to work overtime as and when required. Applicants must possess 5 GCSEs at grades A - C which must include Mathematics and English.

Location: Batts Combe
Closing Date: 29/11/13
Hiring Manager: Lawrence, Neil
Hiring Manager Contact Number: 07841 686312

For more details, please check the following website:
http://ssl.rullionsolutions.com/hnsn_prod/guest/vc_css_job_search?
**Academic Vacancy**

**Research Fellow in Structural Engineering: impact and blast loading effect on reinforced concrete flat slab-column connections**

Department of Civil and Environmental Engineering
University of Surrey -FACULTY OF ENGINEERING AND PHYSICAL SCIENCES

Ref: 9739
Salary up to £32,267 per annum (Subject to experience and qualifications)
Closing date: Monday, 09th December 2013

We are seeking to recruit a Postdoctoral Research Fellow to undertake a research project funded by the EPSRC working within the Civil & Environmental Engineering Department in the Faculty of Engineering and Physical Sciences at the University of Surrey. The project is initially for 3 months but with a strong possibility to extend for a further 3 to 8 months and opportunities for future collaborations within the Centre.

We are looking for a highly able, enthusiastic and collegiate individual, with research experience in structural engineering, FE modelling, dynamics and progressive collapse analysis. Applicants should hold a PhD in Structural Engineering or a related topic and will be expected to take a leading role in carrying out the research work.

The primary aim of the project is the validation of theoretical models for impact, blast loading and progressive collapse of RC flat slab-column connections. The work will also include FE modelling of different structural systems. The candidate is expected to take an active role in disseminating the findings through technical reports and publications, and presentations to the structural engineering community. The post holder will join a strong international team, which includes industrial and research experts in Arup (UK) and EPFL (Switzerland).

Informal enquiries may be made to Dr Juan Sagaseta (T: +44(0)1483686649, E: j.sagaseta@surrey.ac.uk). For an application pack or to apply on-line please go to www.surrey.ac.uk/vacancies. If you are unable to apply on-line, please email fepshroffice@surrey.ac.uk. Please quote Vacancy Ref. 9739.

Closing date for applications is: Monday, 9th December 2013

For further information about the University of Surrey, please visit www.surrey.ac.uk Apply to submit your application

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**PhD Opportunity: Sustainable Construction Materials and Practices**

University of Edinburgh

**Project description:** Engineers and architects are striving to design new and retrofit existing infrastructure that are more sustainable. The objective of this project is to develop and evaluate sustainable materials, specifically biocomposites, for use in construction and to evaluate the impact of design and construction practices on the sustainability of infrastructure.

Biocomposites are materials composed of natural fibres and biopolymers with properties appropriate for use in infrastructure. The research student will experimentally evaluate and computationally model a variety of biocomposites comprised of different materials and processed by a variety of fabrication methods to optimize mechanical behaviour and durability. The student will conduct mechanical testing in the laboratory and evaluate durability based upon in-situ and accelerated conditioning.

The student will work to improve accelerated conditioning methods to more effectively model the effects of real-world environments using experimental testing results, degradation simulations, and real-time weather conditioning for a large group of materials.

Finally, the student will evaluate how design and construction practices can be modified to improve the sustainability of infrastructure using life cycle analysis and develop design tools to allow engineers to effectively implement recommended changes.

**Eligibility and qualifications:** Applicants must be of outstanding academic merit: a first class or upper second class honours undergraduate degree (or International equivalent) is the minimum qualification requirement. Candidates for this position should have degree in a suitable subject (e.g., civil or structural engineering, mechanical engineering, materials science). Experience with research into materials, experimental testing and/or computational modelling is desirable but not essential as training in these areas is part of the studentship. Excellent organisational and communication skills are required. The KTP Associate should ideally be qualified at Masters (MEng/MSc) or post-doctoral level with a degree in concrete materials, structures or civil engineering, naval architecture and a preferred knowledge of marine concrete, materials/grouts, laboratory physical modelling and experimental design. Working within a small highly motivated team and be prepared to travel within the UK.

Please apply via the 'Apply' button.

Select the Research Area: Infrastructure and the Environment and clearly state on your application form which project you are applying for and the relevant supervisor.
Young Researchers’ Forum II: Construction Materials
19 Feb 2014
University College London, London, UK
http://www.ucl.ac.uk/aim/conference-info/yrf

The 2nd Annual International Conference on Architecture and Civil Engineering
24-25 Mar 2014
Singapore
http://www.ace-conference.org/

Structural Faults and Repair--2014
8-10 Jul 2014
Imperial College London, London, UK
http://www.structuralfaultsandrepair.com/

The 4th International Conference on Durability of Concrete Structures
24-26 Jul 2014
Purdue University, West Lafayette, IN, USA

The Twelfth International Conference on Computational Structures Technology (CST2014)
2-5 Sep 2014
Naples, Italy

The 34th Cement and Concrete Science Conference
14-16 Sep 2014
University of Sheffield, Sheffield, UK
http://www.shef.ac.uk/ materials/ccs2014

The 10th International Symposium on Innovation & Utilization of High-Performance Concrete
16-18 Sep 2014
Beijing, China
www.hpc-2014.com

CONMOD 2014 RILEM Symposium on Concrete Modelling
12-14 Oct 2014
Tsinghua University, Beijing, China

First international conference – Calcined Clays for Sustainable Concrete
Jun 23-25, 2015
Swiss
Self-introduction

Leon Black is a Senior Lecturer in Civil Engineering Materials at the University of Leeds. He followed a BSc in chemistry and MSc in analytical chemistry with a PhD (Understanding the Factors Influencing the Development of a Patina on Architectural Lead), all from the University of Bristol. This was followed by an EU fellowship at the Institute for Transuranium Elements then a research fellowship at the Institute for Technical Chemistry in Karlsruhe, Germany. He returned to the UK in 2004 as a research fellow at the Materials and Engineering Research Institute (MERI), Sheffield Hallam University, before moving to Leeds in 2007.

Main field of interest

He is a surface analytical and materials chemist, with emphasis on inorganic analysis. His research interests include characterisation of building materials, particularly cement and concrete, and their degradation mechanisms, e.g. carbonation and sulphation reactions.

His work has in the past involved the use of various analytical techniques, including Raman spectroscopy and X-ray photoelectron spectroscopy, for the characterisation of cementitious materials. Most recently this involved collaboration with the Technical University of Munich into cement prehydration.

He currently has a number of students investigating the durability of low-clinker cement systems and is also interested in the optimisation of cementitious binders for low carbon.

Besides his research interests, he is a Fellow of the Institute of Materials, Minerals and Mining (IOM3) and past-chair of Institute's Cementitious Materials Group. He is also on the Editorial Boards of Advances in Applied Ceramics and Advances in Cement Research and Cement and Concrete Research, and serves on the Steering Committee of Nanocem (a pan-European network of academics and industrialists researching the fundamental science of cement and concrete).

Mr. Mark Whittaker

Prior to my engagement in research, I completed a Masters in Civil and Environmental Engineering from the University of Leeds in 2010. During that time I was first introduced to cement research. My very first project probed the engineering performance of composite cements, followed by cement prehydration in my final year. From there, I quickly continued my education with a PhD, still at Leeds, under Dr. Leon Black’s supervision. With a big drive to move away from traditional neat cement systems, my research focuses mainly on blended cements and their durability; more specifically slag cement blends exposed to external sulphates. The works relies on strong characterisation, chiefly XRD-Rietveld and SEM analysis, prior to linking to performance.

We are looking forward to meeting you here......
More information on the Cement and Concrete Group, with a comprehensive links page, can be found at:
http://www.iom3.org/CMC

International materials, minerals & mining organisations
http://www.iom3.org/content/linkmsai

**Venue Hire**

The Institute offers a range of venue hire options at both its headquarters in London's West End and its new state-of-the-art centre in Grantham.

The **Boilerhouse** has been transformed by IOM3 with the use of cutting-edge materials into one of the most striking buildings outside London. Located 5 minutes from the A1, the venue features unique spaces, offering different facilities for a wide range of uses including meetings, workshops, conferences and exhibitions.

See the Boiler house website for full details of rooms, rates and capacities.

**1 Carlton House Terrace** offers a range of rooms suitable for board meetings for a dozen people, right up to dinners, conferences and receptions accommodating up to 120.

Full room layouts, capacities and rates.

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This newsletter is a compilation of items sent by subscribers or obtained from reliable sources. It is assumed that the information sources are accurate, and neither Editorial Board nor the IOM3 bear responsibility for the accuracy of this newsletter.

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“Do not go where the path may lead; go instead where there is no path and leave a trail”

- Ralph Waldo Emerson
Broekmans, Maarten A.T. M. and Pöllmann, Herbert.

‘Applied Mineralogy of Cement and Concrete’


The book series Reviews in Mineralogy and Geochemistry has, for almost forty years, produced some of the most authoritative reviews in the mineral sciences. This latest edition concerning the mineralogy of cement and concrete maintains this high standard and is a very welcome addition to the series, bridging a gap in the literature which will ensure its position as a standard reference work. The editors are both well respected mineral scientists, who have contributed significantly to the study and understanding of cements. Their complementary interests put them in a strong position to lead the development of this work and together with their eleven co-authors they have produced a volume of considerable merit. As with other works in the series, this book is densely printed on high quality paper, very well illustrated with line drawings and half-tone photographs, and is thoroughly referenced. In the hands of other publishers, the physical format of the book might have expanded considerably, but in keeping with its predecessors, this review remains both compact and a pleasure to read.

Herbert Pöllmann’s opening chapter on Calcium Aluminate Cement (CAC) reflects his great enthusiasm for the subject and his characteristic attention to detail. He clearly and succinctly describes the technology of CAC production, the phase relationships of the clinker minerals and their crystallographic structures. Their hydration is illustrated through the use of dynamic (‘stacked’) diffraction patterns and excellent micrographs, which combine to lead the reader through the subtleties of CAC hydration, before concluding with notes on their applications.

Chapter 2, by Harald Justnes, considers the very topical field of Alternative Low-CO₂ ‘Green’ Clinkering Processes. This chapter is both comprehensive and very timely, reflecting the global search for means by which the cement industry may reduce its CO₂ output. It is commonly misrepresented elsewhere, that cement clinker is a CO₂-intensive material, whereas it is really the vast scale on which it is produced that makes its impact so significant (third only to the power and transport industries). Justnes opens by describing the issue in terms of conventional cement production and describes alternative clinkers such as high belite, calcium sulphoaluminate and calcium aluminate systems, reporting their roles in reducing CO₂ from cement. The chapter concludes by examining the potential of materials other than limestone as practical precursors to cement clinker.

Paul E. Stutzman has written the third chapter in which he reviews the Microscopy of Clinker and Hydraulic Cements, which opens by considering its historical basis over the last century and more. The chapter describes the care necessary in preparing samples for optical and electron microscopy and reports the procedures required to optimize the methods (including mounting, polishing and etching). The remainder of the chapter is focused on quantitative methods in microscopy and describes its evolution from point counting to recent advances in image analysis, drawing comparisons with X-ray diffraction (XRD) and tomographic methods.

The fourth chapter, Industrial X-ray Diffraction Analysis of Building Materials, combines contributions from Roger Meier, Jennifer Anderson and Sabine Verryn and begins by describing their goal of taking diffraction methods from the laboratory into an industrial setting for routine and rapid analysis of cements. The principal modern methods of spectrum collection, phase identification and quantification are described and then expanded to include recent advances in data handling. In particular, the vast quantity of data potentially collected by modern diffractometers has generated new applications of associated numerical methods such as cluster analysis, and the partial automation of structure refinement by Rietveld methods. The rapidity of generating such quantitative results has lead to the growth of computer tomographic methods which are discussed here. The remainder of the chapter shows a number of good examples of how modern diffraction methods can be used in industrial applications to increase our understanding of the processes active in cement production and the analysis of concrete.
Reitveld Quantitative Phase Analysis of OPC Clinkers, Cements and Hydration Products is the subject of Chapter 5, by Miguel A.G. Aranda, Ángeles G. de la Torre and Laura León-Reina, which begins by describing the theoretical basis behind quantitative phase analysis using XRD, as originally proposed by Hugo Reitveld. The authors describe the practical requirements of sample preparation and the instrumental settings necessary for optimal quantitative analysis along with the principal crystalline phases that are likely to be present and the numerical methods used to quantify them. There follows a set of detailed examples of phase quantification, using both conventional diffraction and synchrotron methods. Amongst these, the authors show how the approach may be used to resolve components in complex systems such as hydrated blended systems and how diffraction methods relate to other techniques of phase analysis. The chapter concludes with guidelines on Reitveld quantitative phase analysis, detailing the steps necessary for optimal use of the method.

Chapter 6 presents a thorough review of Supplementary Cementitious Materials (‘SCMs’) written by Ruben Snellings, Giles Mertens and Jan Elsen. As with Chapter 2, this is a very timely and topical review and for the same reasons of resource efficiency and CO₂ reduction. The chapter considers the historical use of blended cements, particularly the resource efficient use of industrial by-products, and then looks at classification schemes by which they may collectively be described. The mineralogical relationships between the phases are harmoniously described, showing the similarities and differences between materials of natural and anthropogenic origin. This, in turn, shows an elegance in the systematic approach in the authors’ description of the contrasting mineral chemistries. Subsequently, the pozzolanic reaction of these materials to form mineral-hydrate assemblages are reviewed from both a kinetic and thermodynamic standpoint. The concluding section focusses on the physical and chemical properties of materials containing SCMs, showing their technical advantages over conventional concrete and mortar.

The final chapter, by Maarten A.T.M. Broekmans is concerned with Deleterious Reactions of Aggregate with Alkalis in Concrete. The scene is set by considering the role of concrete in the modern built environment and the importance of durability and the confidence with which it must be assured. Alkali aggregate reactions (AARs) are defined and described historically, before exploring the sources of alkali reactants in concrete and examining their impact on concrete in service. Much of the chapter concerns the major mechanism of alkali silicate reactions showing, with high quality images, the effect and consequence of such deterioration. Many good examples illustrate the text, which also includes a description of the (rather less common) alkali carbonate form of AAR. The use of microscopy in identifying and quantifying AARs is compared with other methods (largely instrumental) by which the processes may be characterized. Broekmans concludes by describing topics for future research, highlighting the research needs in five key areas.

Overall this book is a ‘collected work’, consisting of an anthology of seven related reviews, which individually are important works in their own right. In combination they represent a comprehensive, thorough and authoritative reference work, which is a pleasure to read. The volume maintains the very high standards expected of this book series and is likely to remain an important reference for many years to come.

M. Tyrer

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