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Chris Taylor is a Fellow of the IVE with over 35 years enamelling experience and is a lecturer for the IVE Basic Approach Course.

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The Institute is not responsible for the opinions and statements appearing in The Journal

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IVE Secretary Angela Nutting
Honorary Treasurer Ben Fieldhouse
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EDITORIAL – SUMMER 2010

So where did the last 5 years go?

Having checked for my last editorial I find it was back in autumn 2005! Well, at the last time of writing, I was still on the right side of 50, but a little apprehensive of the approaching milestone. Now let me just say, that for anyone under 50 and in anyway concerned about the advancing years, this barrier is nothing to worry about. After all and I can confirm that 50 is the new 30!

With regard to the IVE and as mentioned by Ben in his spring editorial, we have a new and exciting opportunity / direction for our Institute to take in the future. The proposed merger with IOM will help to secure the long-term future of the IVE and also for its members, opening up the enamelling world to designers and potential users, who would never have considered Porcelain Enamel as a coating option in the past. This is a fantastic opportunity for the companies remaining in this industry! You will hear much more on this in the coming months.

Looking back over recent years, we have lost many long and established names from our industry in the UK and Eire. GDA, Electrolux, Hygena, Samsung, CRS, QPE and Bitech, maybe I have missed some of the smaller manufacturers. Based on these companies alone, some 1500T of enamel volume has disappeared from these shores. Much has moved to a cheaper manufacturing base in Poland, some relocated to other manufacturers remaining in the UK and some lost completely. I do not think we will ever get back to a market in England and Ireland where we consume 4000 - 5000T therefore the IVE has to change or die!

On a more positive note, looking at the remaining enamelling companies, we can see a very strong and resilient core, these companies are either very well established, or offer innovative products. I remain optimistic that these companies will survive and flourish over the coming years.

I did not think 5 years ago that I would be reporting the demise of Escol. However, the loss of business in the UK and difficult trading conditions in other European countries resulted in much lower volumes for PE.
Luckily for Ferro and for me in particular, we were able to take on 2 key members of the Escol team, Malcolm Heyes and Tony Curtis. We would have liked to have employed more, but unfortunately, the economic conditions meant that this was not possible. Both Malcolm and Tony have settled into their new roles exceptionally well and are bringing their knowledge and experience to Ferro and customers both in the UK and abroad. They have done an excellent job, along with Alain Aronica and his team in France to ensure that we have managed to keep the market supplied, over 200 Escol references have been manufactured by Ferro plants and customers supplied during this very difficult past 10 months. Believe me this has been an enormous task.

For Ferro to remain competitive in the marketplace many very difficult decisions have had to be taken and you will all know that the Rotterdam plant was closed, with product manufacture moving to Ferro Spain. Unfortunately, this has resulted in the loss of many very good people, most notably for the UK market the loss of Ian Lones, known to just about everyone in the IVE and who did a splendid job for Ferro with our UK customers. These very difficult decisions, however painful I trust show that Ferro plan to be around and the leading supplier of PE to this market for many years to come.

Talking of very difficult decisions, we now have what is still a fairly new coalition government. It seems they are willing to take the difficult decisions needed to reduce the enormous deficit run up by the last government. Hopefully, therefore we should not be treading the same path as Greece.

The Devey household has over the past 3 months done our best to re-start the UK economy single-handedly and support David Cameron, by buying a new house and purchasing new fixtures and fittings, I hope it will help!

I now plan to take a holiday.

Mark Devey
Ferro GB

--ooOoo--
Present:

In the Chair  Mr M Nutting                Chairman of Council
             Mr M A Collins                President

Twelve Members present.
(This number comprising a quorum as required by The Articles of Association).

Also present  Mrs A C Nutting            Company Secretary

Minutes of the Seventy Fifth Annual General Meeting

The minutes of the Seventy Fifth Annual General Meeting of The Institute of Vitreous Enamellers, held at the Longford House, Watling Street, Cannock Thursday 24th September 2009, published in The Vitreous Enameller”, Vol. 60, Number 3, Autumn 2009, were taken as read. Acceptance was proposed by Mr C Taylor, seconded by Mr J. Mullis and approved unanimously. The Chairman signed the minutes of the Seventy Five Annual General Meeting.

Annual Report from the Chairman of Council

The Chairman of Council, Mr M. Nutting, presented his report on the activities of Council and of the Institute during the previous twelve months. His report is quoted verbatim:

Chairman’s Report for 2010

Here we are, 2010, a new decade. We have all chosen a new government for the UK, which has turned out, after much negotiation, to be a coalition between
the Conservatives and The Liberal Democrats. Let us hope they can have an impact on all of our futures and I hope they change from the Governments of the past and truly support Manufacturing in the UK.

In matters closer to home I have been elected as your new Chairman, something I have resisted in the past, mainly for personal reasons, but something that I am very proud to do. I consider it an honour to represent all of you and the industry that I love so much.

The vitreous enamelling industry like many manufacturing bodies has taken a real hit in the last few years, companies closing down, others moving to Eastern Europe to benefit from lower cost centres and a lack of innovative thought to develop products that require such a durable surface coating. All of this has resulted in a smaller vitreous enamelling community, no frit suppliers manufacturing within the UK and smaller membership numbers for IVE.

So where have we gone wrong, well it has just been announced that the world gathering of enamellers in Chicago USA is to be cancelled, I believe this is due to a fear of running the event at a loss due to a lack of support from all around the world. This really has been a world wide recession, the whole world is in a time where change is necessary and only the future will be able to measure the success of these changes.

So what changes are there for the IVE, well as you are all aware we have been looking into a merger, for some time now with another trade organisation. Negotiations were first started with IOM³ some time ago, by our previous Chairman Dr Simon Cook and council member Saqlain Ali. These negotiations will reach a conclusion in the next few weeks and I for one hope it will be a positive outcome, so that Vitreous Enamel can get the exposure and opportunity to display its many outstanding qualities.

I would like to thank Dr Simon Cook for all his previous hard work as Chairman and his work towards achieving the merger with IOM³, both as Chairman and in his current supportive role. I am sure you will join me in thanking Mike Collins and Saqlain Ali for their dedication working on the negotiating committee and of course special thanks to all of the hard work by the IOM³ negotiating committee whose help and assistance has been in valuable to the process.

I truly hope that in the coming weeks this merger will be finalized and we can move forward promoting and supporting the whole of our industry.
Report from the Honorary Treasurer.

The Honorary Treasurer, Mr B. Fieldhouse presented his report on the trading accounts for the period ending December 31st 2009. Copies of the accounts have been previously sent to all paid up and applicable UK and EEC members. The report presented is quoted verbatim:

Financial report for the year ending 31st December, 2009

The Institute has made a loss of £6,703 this financial year. We did expect a loss for the year but with the cancellation of the Vitreous Enamel Technology Course, the seminar and with the loss of a number of members and subscribers the loss was slightly higher than anticipated. Fortunately the expenditure costs were not as high otherwise the loss for the year would have been a lot worse.

Expenditure costs were lower than anticipated; this was due to the cancellation of both the Vitreous Enamel Technology Course and the Seminar.

The retained funds for the Institute are still healthy at £39,078.

It is likely, in the present economic climate, that losses will continue year on year for the foreseeable future. Clearly some actions are required to maintain these funds or the remainder will be rapidly eroded.

Approval of the Accounts for the period 31st December 2009

The adoption of the financial report and accounts for the year ending 31st December 2009 was proposed by Mr S. Ali, seconded by Mr C. Oldfield and unanimously approved.

Election of Officers for the year 2011

The Chairman announced that the President, Mr M. Collins, was willing to continue in office for a further year commencing January 1st 2011. Acceptance was proposed by Mr J. Mullis, seconded by Mr C. Taylor and unanimously approved.

The Chairman announced that the Honorary Treasurer, Mr B. Fieldhouse, was willing to continue in office for a further year commencing January 1st 2011. Acceptance was proposed by Mr C. Taylor, Seconded by Mr P. Bond and unanimously approved.

The Chairman announced that the Company Secretary, Mrs A. Nutting, was willing to continue in office for a further year commencing January 1st 2011. Acceptance was proposed by Mr M. Collins, Seconded by Mr B. Fieldhouse and approved unanimously.
Report from the President

The President, Mr M. Collins then addressed the meeting. The report presented is quoted verbatim:

My last year’s address was only 9 months ago when I was reinforcing your Council’s resolve that the Institute needed to change, either by restructure or association or merger with another body.

Well, as you all now know, we have moved on apace. This just shows that when there is need we are capable of real focused action and we can do it.

We have negotiated a proposal for a full merger with IOM3 - the Institute of Materials, Mineral and Mining. I won’t go into the details as you will have received the document detailing the principles and proposals sent to all IVE members. I urge you to consider this proposal very carefully and hopefully come to a conclusion agreeing with your council that this is the best way forward to secure a future for technical representation of the vitreous enamelling industry. This proposal will be put to the vote of members of all grades in the next few weeks. I urge you to support the proposal and most of all please use your vote. We would like to see a clear result from the majority of the members of IVE. Remember, it is not only the future of the IVE, but your future too. So please make some time to consider all of the documents which you have received and use your vote to secure our future. The result of the vote will be put to an Extraordinary General Meeting to be held in about 6 weeks time. Following on from this current meeting, there will be a joint presentation by the negotiating committees from IVE and IOM3 at which you will be able to put your questions and concerns and you will get answers.

My sincere hope is that you will continue to support IVE which will become (assuming the proposal is approved) IVE - The Society of Vitreous Enamellers. It will not run by itself and will require dedicated input to ensure its success. The IOM3 team have told us - you will only get out what you put in. I don’t agree with that - after seeing the benefits of becoming part of the vibrant organisation that is IOM3, with some effort and enthusiasm our members will get back much, much more. But I do emphasize we will still need to work at it and make it a success - it will not happen if we just sit back and wait.

There is not much more to say, really; except to say thank you to Angela Nutting for keeping us on the straight and narrow - despite our best efforts to make things difficult for her. Thanks also to Simon Cook for his drive and enthusiasm and of course not forgetting a few SWOTS during his chairmanship.

Thanks also to Mark Nutting for taking over as Chairman at such a critical time. Thanks to the negotiating team who have worked so hard to put together the merger proposal.
This will almost certainly be the last Presidential Address to the Institute of Vitreous Enamellers. So I would like to “sign off” and let you all know that I am proud and honoured to have been part of a very special family for the best part of 40 years. Remember just a few of those people who have made it a success and are no longer with us - John Gardom and his father before him, a whole family of Gray’s, Gordon Blow, Laurie Curley, Tom Vaughan, Brian Saunders, Ken Phipps, Jimmy Baines, Peter Duff, Baz Critch, Wilf Ball, to mention just a few and of course last but not least my late wife Christine. Thanks to all of you who are still with us and are will carrying on our great traditions and to those who will carry them forward into an exciting future.

I would like to say thank you to everybody I have met, worked with, argued with and probably annoyed. I wouldn’t have missed it for the world!

Thanks!

Election of Three Members of Council for the years 2011 –2013

No nominations had been received for Personal Member representation on council. The retiring member Mr P Bond has indicated that he will be retiring at the end of his term. Mr J. Mullis had indicated his willingness to continue and thus no election was necessary. The re-election was proposed by Mr S. Ali, seconded by Mr M. Devey and unanimously approved.

For Company Member representation on Council, no ballot had been required. The Retiring Members Hytech Enamellers Ltd, (represented by Mr M. Stickler), Kingfisher Enamelling Co Ltd (represented by Mr M. Nutting) and Rio Tinto Minerals Ltd (represented by Dr S. Cook) had indicated their willingness to continue and thus no election was necessary. Their re-election was proposed by Mr B. Fieldhouse, seconded by Mr C. Taylor and unanimously approved.

The Secretary, Mrs A Nutting was asked to add the full elected constitution and officers of the Council of the Institute for the year commencing January 1st 2011 to the minutes.

Officers

President: Mr M A Collins
Chairman: Mr M Nutting (2nd Year)
Deputy Chairman: Mr S Cook
Honorary Treasurer: Mr B Fieldhouse
Publications Editor: Mr M Moriarty
Company Secretary: Mrs A C Nutting
1 Year period ending 31st December 2011

Company Member representatives:
- Corus Plc (Mr R van Duijn)
- Trico VE Ltd (Mr C Oldfield)
- Arcelor (Mr P Gousselot)

2 Year period ending 31st December 2012

Company Member representatives:
- Ferro (Great Britain) Ltd (Mr M Devey)
- Permastore Ltd (Mr S Ali)

Personal Member representatives: Mr C Taylor

3 Year period ending 31st December 2013

Company Member representatives:
- Hytech Applications Ltd (Mr M Stickler)
- Kingfisher Enamelling Co Ltd (Mr M Nutting)
- Rio Tinto Minerals Ltd (Dr S Cook)

Personal Member representatives: Mr J Mullis

Appointment of Accountants

The Chairman stated that the accountants were satisfactory and he saw no reason to change. This was proposed by Mr B. Fieldhouse, seconded by Mr J. Mullis and unanimously approved.

Any Other Business

Mr Collins proposed that a bye-law be passed to allow honorary members to be able to vote at AGM and EGM Meetings. This was seconded by Mr C. Taylor and unanimously approved.

The Chairman thanked all for their attendance.

This concluded the business of the meeting.

--ooOoo--
EVENTS CALENDAR

29 Aug 2010
Venue: Budapest, HUNGARY
Contact: Klára Lang
Tel: (+36 1) 457 0542, (+36 20) 9252 816
Email: diamond@diamond-congress.hu
Web: http://www.mecc2010.org/

29 Aug 2010 - International Conference on Ceramic Processing
01 Sept 2010 Science, ICCPS-11
Venue: Zurich, SWITZERLAND
Contact: Prof. Ludwig Gauckler
Tel: ++ 41 44 632 3760
Email: ludwig.gauckler@mat.ethz.ch
Web: http://www.iccps11.ethz.ch/home

08 Sept 2010 - Society of Glass Technology Annual Conference
10 Sept 2010
Venue: Cambridge, UK
Contact: Christine Brown
Tel: +44 (0) 114 263 4455
Email: christine@glass.demon.co.uk
Web: http://www.cambridge2010.sgthome.co.uk/

15 Sept 2010 - 7th Global Foundry Sourcing Conference 2010
16 Sep 2010
Venue: Qingdao, CHINA
Contact: Jorcelyn Park, International
Tel: +86-532-8380 5316
Email: sales@fsc86.com
Web: http://www.foundry-suppliers.com/
    China Foundry Suppliers Union
THE VITREOUS ENAMELLER

27 Sept 2010 - 01 Oct 2010
Tecnargilla 2010 - the Future of Ceramics
Venue: Rimini, ITALY
Tel: 0541 744 468
Email: info@acimac.it
Web: http://www.tecnargilla.it/

28 Sept 2010 - 29 Sept 2010
15th Galvanizing & Coil Coating Conference
Venue: Istanbul, TURKEY
Contact: Agata Kazmarek,
Tel: +44 (0) 20 7779 8989
Email: marketing@metalbulletin.com
Web: http://www.metalbulletin.com/events/

--ooOoo--
COMPANIES URGED TO PUT ENGINEERS ON THE BOARD

The traditional focus on financial, legal and accountancy qualifications and experience within UK company boards is not enough to avoid business disaster, according to a report from SMF the Sainsbury Management Fellows’ Society (SMF). The Society is urging HR directors to consider professional engineers with business qualifications and experience as an attractive complementary skill base for board positions.

SMF believes that to increase the competitiveness of the UK economy more directors with the knowledge of how products are imagined, designed, made and work are needed in UK boardrooms. This, it says, would help drive organisations forward, maximising innovation and the opportunities of new markets while controlling and mitigating the inherent risks in rapid growth businesses.

SMF undertook a survey among HR directors to establish the level of awareness within the HR community of the suitability of engineers to fulfil these important roles. Results show that, while 86% surveyed said they were open-minded about employing directors with non-financial or legal backgrounds, fewer than two thirds believe that engineers have the skills and attributes necessary to move onto boards.

SMF President, David Falzani said: “Our research shows a discrepancy between perception and recruitment reality. Over 250,000 engineers are employed in the UK, contributing to the economic strength of the nation and it is essential that organisations understand the benefits they can derive from having an engineer among its management team.

“Historically, engineers have not been seen as a natural choice to be members of boards of blue chip organisations,” Falzani went on. “Conventional wisdom means candidates tend to come from financial and legal disciplines. However, HR directors are discovering that once engineers possess the requisite legal, financial, and marketing training, they have a breadth of skills that can be used to help organisations grow faster and more reliably.”
SMF has produced a booklet for HR directors encouraging them to seek more information on the role of professional engineers in the corporate world. Within the booklet is a skills matrix to assist in the assessment of an organisation’s needs and how a business-qualified, professional engineer can enhance the board. Copies of the booklet are downloadable from www.smf.org.uk.

Source: Works Management Website (www.worksmanagement.co.uk) – 13 August 2010

AGA ENJOYS ‘SOUND’ HALF YEAR AND RAMPS UP RANGEMASTER PRODUCTION

The cast iron cooker specialist Aga today (7 July) reported a ‘sound’ six months and promised it would ramp up production of its Rangemaster cooker model but continue its cost reductions programme as it strives to rebuild profitability.

Chief executive William McGrath said the company enjoyed “a sound first half” as activity levels ticked up with the Rangemaster cooker range providing “considerable impetus”. He went on: “The sustained and innovative work on our product offering and in supporting our brands, alongside the cost base reductions made, all mean we are well positioned for a recovery.”

In a trading update Aga said its performance was in line with expectations and had made steady progress with Rangemaster cooker sales providing a boost while consumer markets remained subdued given current economic conditions. The plan for 2010 remained to rebuild profitability and to generate cash as markets improved given continuing cost reduction programmes, strong operational gearing and a systematic investment in product development.

Sales of AGA cast iron cookers were reported as being up in the first half and the current level of sales leads suggested that 2010 would prove better than 2009, even though sales of the all-in-one cooker and boiler Rayburn and Stanley models were appreciably lower.

The company said that Rangemaster had another good half year. Sales through design centres, featuring the broader Rangemaster appliance offering, had performed well. Sales on the near continent had been particularly strong reflecting an established long run growth pattern. After a slow start, first half order intake for Rangemaster was up over 8% on 2009 and production is being increased from budgeted levels for the second half of the year.
Closer integration of operations continued to bring benefits, notably between Aga and Rangemaster in the UK. In addition, in North America, a decision to make Aga’s new state-of-the-art Greenville, Michigan site the production and distribution centre for hot, as well as cold products, will see the company’s cooker production facility in Ontario close later this year.

Home fashions lines overall improved but remained loss-making with Fired Earth revenues down while orders were up and for the Grange furniture business orders and revenues were ahead. Cookware lines from Aga and Divertimenti performed well.

Source: Works Management Website (www.worksmanagement.co.uk) – 7 July 2010

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HEALTH, SAFETY & ENVIRONMENT NEWS

WORKER DEATHS IN BRITAIN FALL TO RECORD LOW

New figures released today reveal that the number of people killed at work in Britain fell last year to a record low. The Health and Safety Executive (HSE) has released the provisional data, which shows that 151 workers were killed between 1 April 2009 and 31 March 2010 compared to 178 deaths in the previous year and an average number over the last 5 years of 220 deaths per year.

Judith Hackitt, the HSE Chair said: “It’s really very encouraging to see a further reduction in workplace fatalities in the past year. This is performance which owes much to good practice, leadership and employee engagement. No doubt the recession has resulted in lower levels of activity in some sectors and a decrease in the numbers of new inexperienced recruits has also contributed to this fall in fatalities.

“We should also remember that 151 families are mourning the loss of someone who last year went out to work and never came home. Being one of the best health and safety performers in the world means continuing to strive to drive these numbers down further - not getting complacent about what we’ve collectively achieved and recognising the new challenges as we emerge from the recession. “As with all health and safety statistics, today’s announcement is a combination of encouraging news about improvement but also a salutary reminder of the tragedies of lives lost at work.”

Despite the overall improvement, agriculture, the most dangerous industry in Britain, has recorded a sizeable increase in deaths. 38 workers died on farms in the last year, marking a disappointing return to levels of earlier years after a record low of 25 deaths in 2008/09. Judith Hackitt added: “We are especially concerned to see the continuing high levels of fatalities in agriculture. “The fact that many of these lives have been lost in family businesses is a double tragedy. Not only have families been ripped apart, but businesses that have been handed down through generations have been ruined. “No industry can or
should regard high levels of workplace death and injury as being ‘part of the job’. It doesn’t have to be this way as many other sectors have shown by their improvement.”

Large falls have been recorded in some of the other historically most dangerous industries in Britain: 41 fatal injuries to construction workers were recorded - a rate of 2.0 deaths per 100,000 workers, compared to an average of 66 deaths in the past five years and a fall from the 52 deaths (and rate of 2.4) recorded in 2008/09. 42 fatal injuries to services workers were recorded, a rate of 0.2 deaths per 100,000, compared to an average of 72 deaths in the past five years and a fall from the 62 deaths (and rate of 0.3) recorded in 2008/09. 24 fatal injuries to manufacturing workers were recorded, a rate of 0.9 deaths per 100,000, compared to an average of 38 deaths in the past five years and a fall from 33 deaths (and rate of 1.1) in 2008/09.

Judith Hackitt said: “We need the agriculture industry to recognise that it can address the problem and learn the lessons from these sectors. Improvements can be achieved even in any industry sector with leadership and by focusing on the priority issues.”

The new figures show that compared with the latest data available for the four other leading industrial nations in Europe - Germany, France, Spain and Italy - Great Britain has, for more than the last six years, had the lowest rate of fatal injuries.

*Source: Health and Safety Executive Website (www.hse.gov.uk) – 30 June 2010*

**CEMARS APPROVED UNDER CRC**

Organisations participating in the CRC Energy Efficiency Scheme now have more ways to showcase their commitment to cutting carbon emissions. The Environment Agency, UK administrator of the CRC, has approved the Certified Emissions Measurement And Reduction Scheme (CEMARS®) as counting towards the CRC Early Action Metric.

Previously only the Carbon Trust Standard was recognised as counting towards the metric, which rewards organisations who voluntarily take steps to better manage their energy use before joining CRC. The decision to approve CEMARS follows extensive consultation with businesses, the public sector and wide range of environmental groups and means CRC participants now
have a choice of scheme and an alternative route for gaining credit for earlier efforts to cut carbon.

CEMARS is the first Carbon Trust Equivalent Scheme to be approved by the Environment Agency, but others are currently being considered. All equivalent schemes will be rigorously assessed and must meet a range of requirements, including demonstrating annual carbon savings.

Andrew Hitchings, CRC Project Executive at the Environment Agency, said: “We are pleased to announce CEMARS as a Carbon Trust Standard equivalent scheme under the CRC Energy Efficiency Scheme. Along with the Carbon Trust Standard, CEMARS allows organisations who are leading the way in environmental management to be rewarded for their efforts to date. “Expanding the early action metric to include alternative schemes will make it simpler for participants to show exactly how much genuine engagement they had with emissions management and reduction prior to joining CRC. “CRC is a great opportunity for businesses and organisations to show what they have already achieved in reducing emissions and demonstrate a commitment to go even further.”

The CRC Energy Efficiency Scheme is administered across the UK by the Environment Agency. The scheme is regulated by the Environment Agency in England and Wales, the Northern Ireland Environment Agency in Northern Ireland, and the Scottish Environment Protection Agency in Scotland. Guidance on the criteria that equivalent schemes to the Carbon Trust Standard must meet to be approved under the Early Action Metric is available on the Department for Energy and Climate Change (DECC) website:
http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/user_guidance/user_guidance.aspx

If you are the provider of a scheme for certifying carbon reduction and management and wish it to be approved as equivalent to the Carbon Trust Standard under the CRC Energy Efficiency Scheme, please apply to the Environment Agency at: http://www.environment-agency.gov.uk/business/topics/pollution/105760.aspx

For more information on the CRC Energy Efficiency Scheme and to find out how your organisation is affected visit www.environment-agency.gov.uk/crc.

Source: Environment Agency Website (www.environment-agency.gov.uk) – 20 June 2010
50 DAYS LEFT TO REGISTER FOR CRC

Organisations that use enough electricity to power a third of all UK homes have signed up to a mandatory scheme to cut their carbon emissions. New figures published today (11 August 2010) by the Environment Agency show that over 1200 organisations have already registered for the CRC Energy Efficiency Scheme. Between them these organisations have reported over half of the electricity consumption expected to be included within the scheme.

Large businesses and public sector organisations have just 50 days left to register for the mandatory scheme and the Environment Agency is now expecting an increase in registrations as the remaining organisations rush to sign up before the September 30 deadline.

Early projections estimated a maximum of 5,000 organisations were obliged to register for the CRC scheme. Revised figures show that the number of organisations required to participate is between 3-4000, as many businesses that qualify for the CRC are owned by larger conglomerates, that incorporate multiple businesses.

Tony Grayling, head of climate change and sustainable development at the Environment Agency said: “Around a third of organisations that we expect to register for the CRC scheme have registered well in advance of the deadline. “We would urge the remaining businesses to sign up now, and not leave registration to the last minute. Our dedicated CRC helpdesk is available to help businesses through the registrations process.”

The CRC Energy Efficiency Scheme is administered across the UK by the Environment Agency. The scheme is regulated by the Environment Agency in England and Wales, the Northern Ireland Environment Agency in Northern Ireland, and the Scottish Environment Protection Agency in Scotland.

All public and private sector organisations that had at least one half-hourly electricity meter (a meter that records energy use every 30 minutes) settled on the half hourly market during calendar year 2008 must register as a participant or make an information disclosure under the CRC Energy Efficiency Scheme with the Environment Agency between 1 April and 30 September 2010. This will account for approximately 20,000 large organisations. 1229 organisations have registered for the CRC Energy Efficiency Scheme. Their combined energy use is around 40,000,000 MwH electricity/year.
Up to 4,000 of these organisations will also be Participants in the scheme. Participants are identified by their 2008 electricity supplies: If the organisation has a half-hourly electricity meter and consumed at least 6,000 Megawatt hours of qualifying electricity through all of its meters during 2008 (equivalent to an annual electricity bill of around £500,000), then it will need to participate in the scheme by monitoring energy consumption and purchasing allowances.

However, if the organisation has a half-hourly electricity meter but consumed less than this amount of electricity, it will need to make an information disclosure via the CRC Registry on the Environment Agency’s website. They will not have to monitor and report their annual energy use or purchase allowances.

Top 10 sectors affected by CRC:

• Engineering
• Plastics / chemicals
• Public sector
• Packaging / paper / board
• Estates / construction / real estate
• Hotels / restaurants
• Steel
• Food manufacturing
• Retail
• Printing

For further information on the CRC Energy Efficiency Scheme visit www.environment-agency.gov.uk/crc Organisations affected by CRC can also contact the Environment Agency for more information on 08708 506 506 or at crchelp@environment-agency.gov.uk or the SEPA helpdesk on crc@sepa.org.uk

Source: Environment Agency Website (www.environment-agency.gov.uk) – 11 August 2010
INTRODUCTION

Evolution of refractory products for the Glass Industry has been relatively slow in recent decades due to the inherent stringent requirement of long campaigns and therefore low risk taking. Even with these constraints however, new products have emerged which provide additional reliability, capability and in more recent times a lower capital cost.

In particular, environmental concerns have been a major driving force behind low NOx glass melters and this has provided a new impetus for refractory development. Low NOx systems tend to be oxy-fuel; this means higher temperatures and increased alkali concentration; both of these place great demands on the refractory superstructure.

Spinel based refractory compositions have been introduced with considerable success; not only in melter superstructure but also been widely applied in burner systems both for the main melter and downstream processing.

Spinel exhibits supreme resistance to alkalis; recent analyses have also revealed that spinel has inherent resistance to both boron and lead. Consequently it is suitable for superstructure applications in SLS, E, C and lighting glass furnaces.

Regenerative combustion systems have dominated melter design since their conception by the Siemens brothers in the 1870’s; end or cross fired tanks feature large refractory structures (regenerators) to transfer heat from the waste gas stream to the combustion air. These structures have generally been
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constructed from either basic or alumino-silicate based refractories, with the former dominating specifically for float glass melter construction. In recent years there has been a significant shift toward the alumino-silicate design which provides a more stable construction (lower creep/expansion), lower heat loss, and in particular a lower unit cost.

Coloured glass production is increasing as designers seek to differentiate their products; not only the traditional green and brown are desired but black and intense blues. Concentrated colourants can be extremely corrosive and irreversibly contaminate the refractory superstructure in the melter.

Consequently many coloured glasses are manufactured in colourant forehearth where concentrates can be added in a controlled way; indeed different colours can be produced from the same glass feedstock thus making the colourant forehearth an extremely versatile production unit. The refractories forming the superstructure of the colourant forehearth have to endure arduous conditions; corrosive oxides and high temperatures. Campaigns can still be quoted in months rather than years; traditional cast products have been replaced by low permeability variants with significant improvement.

Although the unit melter is now the primary method of glass production; for centuries glass has been melted in batches in large clay based pots. This “pot furnace” method is still widely applied for lead/baria crystal production and melting of bespoke compositions. Clay based pots require densification/tempering processes and provide a relatively short working life before clay derived defects are evident in the glass.

A novel AZS product has been developed which requires minimal pre-heat prior to use and provides excellent glass quality; an AZS with exceptional thermal shock resistance this product is now finding applications in dog house arches and burner blocks.

Mullite is a broad generic term which covers a wide variety of compositions. “Special” glasses some based on alumino-silicate compositions require melting temperatures >1650°C; silica crowns are not appropriate and mullite is widely utilised. Mullites however are not “created equal”, specifically bond integrity effects creep resistance and this is critical for secure operation.
SPINEL; PROVIDING AN ALTERNATIVE TO SILICA AND FUSED CAST IN OXY-FUEL

Spinel exhibits an inherent resistance to alkalis (Na, K + mixtures) which makes it an ideal product for the superstructure of oxy-fuel melters or indeed superstructure of conventionally fired melters where alkali is concentrated.

Silica is the traditional choice for melter superstructure; breastwalls, frontwalls, backwalls and crown. However in alkali laden environments particularly oxy-fuel; where an increase of volatile alkali species has been variously reported from 3 to 6 times, silica has exhibited accelerated wear. This wear is created by concentrated alkaline hydroxides which react with the silica refractory to form sodium silicates. At melter temperatures in conjunction with high moisture content, these silicates exhibit a high degree of fluidity and therefore drip.

Spinel is stable in operation and none of the aforementioned criteria apply.

To demonstrate the relative stability of silica and spinel in alkali laden atmospheres equilibrium thermodynamic calculations were performed using the FACT package. The Gibbs energy minimization module EQILIBRIUM was used together with FACT databases.

Fig.1 & 2 consider 100g of silica or spinel solid phase respectively and examines the predicted phase constituents on successive additions of NaOH that is increasing the NaOH/SiO₂ or NaOH/MgO.Al₂O₃ ratio, α, at a temperature of 1900K.

From the thermodynamic calculations; the fundamental intrinsic stability of spinel in alkali laden conditions versus silica is clearly shown.

In the case of silica only 1g of Na₂O is required (alpha ~0.01) to digest 100 g, whereas spinel requires nearly 36g. To demonstrate this on a laboratory scale two vapour corrosion tests were conducted. In the first finger test specimens were held over an alkali enriched glass, and in the second block specimens were sealed over crucibles containing pure alkali (Na₂CO₃), and mixed alkalis (Na₂CO₃, K₂CO₃).
Fig. 1: Predicted phase evolution of SiO$_2$-NaOH system at 1900 °K as a function of $\alpha$.

Fig. 2: Predicted phase evolution of MA spinel - NaOH system at 1900 °K as a function of $\alpha$. 
Fig. 3: Soda vapour test, 1500°C, 7 days. Spinel (top) Silica (bottom)

Fig. 4: Vapour Contact Test Pieces, 1600°C, 5hrs 
Na₂O left - Na₂O/K₂O right. Silica (top), Spinel (bottom).
Fig. 5: Proposed typical melter crown construction; all layers are alkali state.

Fig. 6: Composite melter, spinel downstream superstructure, low glassy phase AZS upstream.
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Fig. 3 (page 23) shows finger test pieces that have been suspended over an enriched alkali glass (+20% Na₂O), for a period of 7 days. Silica showed an average weight loss of 30%, the spinel composition displayed no weight change.

Similar thermodynamic calculations have been conducted considering a flux of sodium borate; these reveal that only 3g of flux are required to digest 100g of silica, 10g/100g of alumina; 12g/100g of mullite but 24g/100g of spinel.

These theoretical results have been verified by ASTM based vapour testing.

This promising testing led to the introduction of a spinel breastwall in an oxy-fuel melter; operating for 8 years the spinel superstructure is in excellent condition. Many other spinel installations and trials are ongoing; a proposed construction of a composite melter design for oxy-fuel utilises the benefits of fused cast (silica batch resistance) and spinel (cost effective, alkali resistance). Designs for the spinel crown and composite melter are shown in Fig 5 & 6. Images from operational melters verify the theoretical capability of spinel to survive alkali and boron laden environs.

Spinel compositions have continued to evolve providing greater flexibility to design, operating limits, and to superstructure repair. These products are outlined in table 1 below: S spinel and Spinel TSR are pressed products; TSR denotes that this product can be hot inserted and has been utilised in fused cast superstructure repair. Spinal C and CHI are cast and therefore provide the capability to produce large and/or complex items. These products have proven performance in oxy-fuel burner systems; specifically forehearth burners where temperatures within the burner can reach 2000°C.

Fig. 7: Spinel crown; 1m span, 3.2 m long, oxy-fuel, 1350°C, lamp glass cullet (Na, Cr, Mn)
ALUMINO-SILICATE (MULLITE) REGENERATOR

For many years the virtues of alumino-silicate (mullite) regenerator construction have been extolled, although basic products continued to dominate some sectors of the glass industry specifically float glass production.

In recent years the established practice has started to change and the primary aspects driving this evolution are:

• alumino-silicates have a linear expansion approximately 1/2 of basic materials; this ensures a tight stable construction and if required different compositions can be interwoven without any detrimental effects to the structure, specifically they will remain “joint tight” during heat-up.

• alumino-silicates (mullites) have excellent creep resistance and new products have been developed with ultimate temperature/load capability to withstand division wall applications.

• Excellent resistance to batch carry-over; basic materials can form fosterite with batch derived silica; this expands on formation and disrupts the refractory structure.

• Low thermal conductivity; heat loss is reduced and wall structures can be made thinner without effect on heat conservation.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>S Spinel (Frimax 7)</th>
<th>Spinel C (Frimax C)</th>
<th>Spinel CHI (Frimax CHI)</th>
<th>Spinel TSR (Frimax HI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al₂O₃</td>
<td>71.9</td>
<td>78.9</td>
<td>68.8</td>
<td>65.6</td>
</tr>
<tr>
<td>MgO</td>
<td>28.0</td>
<td>20.4</td>
<td>24.0</td>
<td>26.7</td>
</tr>
<tr>
<td>CaO</td>
<td>0.19</td>
<td>0.28</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>SiO₂</td>
<td>0.06</td>
<td>0.11</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>0.03</td>
<td>0.12</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Na₂O</td>
<td>&lt;0.03</td>
<td>0.17</td>
<td>0.12</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>ZrO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C/S Ratio of bond</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C/A Ratio of bond</td>
<td>0.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSR (cycles 950°C to water)</td>
<td>5</td>
<td>27</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

XRD phase analysis

<table>
<thead>
<tr>
<th>MA</th>
<th>Major</th>
<th>97.3</th>
<th>87</th>
<th>95</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Minor</td>
<td></td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Not detected</td>
<td>2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSZ</td>
<td></td>
<td>11</td>
<td>6.2</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 8: Spinel crown; 2.7m span, 3.8m long, gasrecuperator, 1450 °C, lighting glass with 1.5% B₂O₃

Fig. 9: Spinel superstructure trial panel in AZS breastwall, 6 yrs 2 months, air-fuel melter, no discernable wear.
Fig. 10: Alumino-silicate Regenerator

Fig. 12: Thermal Profiles & Insulation
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A summary of the mullites utilised in regenerator design are shown in table 2 above:

It is critical that the “mullites” are zoned correctly through the vertical section of the regenerator. At temperatures above 1270°C glassy reactions occur between the alumino-silicates and alkali; this forms impenetrable layers slowing wear to just a few mm per annum. High mullite content products are chosen for these high temperature zones (wall above packing, target wall, crown and port neck) due to their excellent creep resistance.

Further down the regenerator and therefore at reduced temperatures; the glassy reaction is replaced by a “dry” reaction and formation of nepheline. To compensate products are supplied with inherent glassy phases to absorb alkali; although it is also important that these products maintain creep resistance.

The zoning of a typical cross-fired regenerator is shown in the figure 10 above.

Mullite derived from andalusite has a unique feature; an outer crystalline matrix of mullite which maintains thermo-mechanical properties with a silica rich core to absorb alkali. As alkali reacts with the mullite crystal exterior silica is released from the core to form a glassy protective layer.

Intrinsic to the success of the alumino-silicate regenerator specifically in float melter design is the unique 97% mullite product. This product readily forms a protective glassy barrier and in this regard out performs mullites based on fused aggregates (Fused Mullite); this characteristic facilitates application in the upstream port target walls and port necks.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>79 (DSF 59)</th>
<th>81 (Frisil G)</th>
<th>90 (Frisil H)</th>
<th>97 (ML31)</th>
<th>Fsd Mullite</th>
<th>Direct Bonded Magnesite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk density (g/cc)</td>
<td>2.48</td>
<td>2.50</td>
<td>2.55</td>
<td>2.52</td>
<td>2.56</td>
<td>2.98</td>
</tr>
<tr>
<td>Apparent Porosity (%)</td>
<td>13.8</td>
<td>13.4</td>
<td>14.1</td>
<td>18.5</td>
<td>17.0</td>
<td>15.8</td>
</tr>
<tr>
<td>CCS (MPa)</td>
<td>86</td>
<td>80</td>
<td>75</td>
<td>90</td>
<td>60</td>
<td>52</td>
</tr>
<tr>
<td>TSR (950°C to water)</td>
<td>4</td>
<td>8</td>
<td>30</td>
<td>16</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Creep, % at 1550°C, 50 hrs</td>
<td>N/A</td>
<td>1.45 (150°C)</td>
<td>0.5</td>
<td>0.109</td>
<td>0.084</td>
<td>0.15 (1400°C)</td>
</tr>
<tr>
<td>Thermal Expansion (%), 20 to 1500°C</td>
<td>0.872</td>
<td>0.54</td>
<td>0.91</td>
<td>0.93</td>
<td>0.80</td>
<td>1.5 - 2.0</td>
</tr>
<tr>
<td>Thermal Conductivity (W/mk)</td>
<td>1.55</td>
<td>1.82</td>
<td>1.76</td>
<td>2.03</td>
<td>2.32</td>
<td>4.5</td>
</tr>
</tbody>
</table>
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The excellent creep resistance of this product is shown in Fig.11 below. Note that magnesia creep figure is derived at 1350°C, 200°C below the mullite test temperature. It is estimated that creep rate doubles for every 100°C increase in temperature, consequently the 97% mullitic product exhibits significantly better creep resistance than magnesia.

As fuel costs spiral the thermal efficiency of all units associated with the glass melter are coming under closer scrutiny. The low thermal conductivity coefficients associated with mullite products, in comparison with basic, offer potential heat savings in conjunction with a thinner working lining (lower capital cost) that can be heavily insulated. Heat loss can be theoretically reduced by 22%.

An example of revised regenerator wall construction is shown in Fig.12 (p.28).

The alumino-silicate (mullite) regenerator design is firmly established; zoning of the structure provides the most cost effective construction in conjunction with excellent campaign life.
Figures 13 and 14 (page 32) show the typical residual thickness of mullite products at the end of the furnace campaign and amply illustrate the capability of these products in regenerator design.

COLOURANT FOREHEARTH; LOW PERMEABILITY PRODUCTS REAP REWARDS

The colourant forehearth provides glass manufacturers the following benefits:

• Ultimate flexibility in regard to colour; no contamination of the melter.
• Different colours from a shared melter (same glass feedstock)
• Wear zone from colourant process confined; lower temperatures encountered in the forehearth.

However a major drawback is the use of colour concentrates that are particularly corrosive to the superstructure refractories and consequently campaigns can be measured in months rather than years.
Fig. 13 Fused Mullite target wall after 13 years operation; container glass

Fig. 14 81% Mullite regenerator crown, approx 93% of original size
Table 3

<table>
<thead>
<tr>
<th></th>
<th>CF1 (DSF G6)</th>
<th>CF2 (DSF G7)</th>
<th>Slip Cast</th>
<th>Ethyl-Silicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al₂O₃</td>
<td>74.4</td>
<td>76.2</td>
<td>78.5</td>
<td>79</td>
</tr>
<tr>
<td>SiO₂</td>
<td>4.17</td>
<td>4.13</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>ZrO₂</td>
<td>20.4</td>
<td>19.3</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>CaO</td>
<td>0.73</td>
<td>0.04</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>0.05</td>
<td>0.05</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Na₂O + K₂O</td>
<td>0.23</td>
<td>0.25</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Density (g/cm³)</td>
<td>3.25</td>
<td>3.16</td>
<td>3.0</td>
<td>2.98</td>
</tr>
<tr>
<td>Bulk density (g/cm³)</td>
<td>3.16</td>
<td>3.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porosity (%)</td>
<td>16.3</td>
<td>20.6</td>
<td>20.0</td>
<td>22.0</td>
</tr>
<tr>
<td>Cold Crushing Strength (MPa)</td>
<td>106</td>
<td>108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Expansion (%) 20 - 1500°C</td>
<td>1.11</td>
<td>1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Permeability (cm²)</td>
<td>2.09 x 10⁻¹¹</td>
<td>4.1 x 10⁻¹¹</td>
<td>1.87 x 10⁻⁹</td>
<td>1.15 x 10⁻⁹</td>
</tr>
<tr>
<td>Creep Deformation Linear Change (%) after 50 hrs @ 1350°C</td>
<td>-1.9</td>
<td>-1.3</td>
<td>-2.7</td>
<td></td>
</tr>
</tbody>
</table>

Refractory products based on traditional casting techniques (ethyl silicate, slip cast), typically exhibit relatively high permeability levels; subsequent penetration of colourant derived vapours results in preferential degradation of bonding phases.

It is crucial from initial start-up that vapour ingress into the refractory superstructure is hindered so that a “neutral” reaction boundary is formed.

Wear of the refractory is then kinetically governed by the solution and not penetration rate. In response to the above criteria; products were developed with low permeability structures. These are shown in table 3 with ethyl silicate and slip cast products for comparison.
Fig. 15  Ethyl silicate AZS  CG1

Fig. 16: Ethyl silicate AZS CG1
THE TESTING OF BALL CLAYS FOR USE IN VITREOUS ENAMELS

(MEMBER’S ZONE PAPER No.4)

The following paper was first published in the Vitreous Enameller in September 1959 and was the work of the IVE’s Technical Sub-Committee comprising of Dr. W.H. Webb, Mr. J.W. Gardom, Mr. J.H. Gray, Dr. B.K. Niklewshi, Mr. S.E.A. Ryder and Mr. J.I. Scott.

The tests carried out on a ball clay for use in vitreous enamel may be concerned either with determining its suitability for a particular enamel or range of enamels, or on the other hand of deciding whether it is identical in composition (including impurities) and physical properties with a previous batch of clay, which has been successful in use. The range of tests is not necessarily the same for the two objectives.

Before dealing with the matter in any detail let us consider why ball clay is used in the mill addition to vitreous enamel. Its primary purpose is to give a suspension sufficiently viscous to hold up the ground enamel. Its subsidiary functions are to give the suspension some thixotropy, which affects the enamel pick-up and to give film strength to the dry enamel. It has other effects, however. In relation to the enamel it is a refractory material which has to be dissolved by the enamel in firing. It therefore affects the acid resistance, gloss and expansion coefficient. In addition one must remember that clay is only a fraction of the cost of enamel frit and on economic grounds, therefore, the maximum proportion tends to be used provided the properties of the enamel are not adversely affected. These characteristics are the positive ones, so to speak, but there are a number of negative ones, i.e. characteristics which may make the clay unstable in spite of its normal physical and chemical attributes. These are normally due to the presence of impurities such as fibre, lignite and limestone which may cause blistering; pyrites and siderite which may cause specking or blistering, or both; rutile and mineral forms of iron oxide which may cause
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colour defects and specking; soluble salts, particularly of di- and tri-valent
metals such as calcium, iron and aluminium which may be present in such
concentrations as to make deflocculation very difficult.

Finally, the presence of very course grains (usually if quartz) may affect the
surface of the enamel. The amounts of these impurities vary in some types of
clay, which in others they may remain reasonably constant. A few ball clays
contain vanadium compounds and sometimes small amounts of chromium
minerals, but these are exceptional.

The routine testing of enamelling clays will be mainly (but not exclusively)
concerned, therefore, with the determination of impurities and the identity of
successive consignments of clay. Although the function of the Committee is
to make recommendations on this particular field of clay testing, it will probably
be of interest to include a few general comments on the fundamental approach
to clays for enamels. There is not space to treat this in detail, so that the
comments are mainly generalisation. If we ignore for the moment the question
of small amounts of impurities, the essential properties of the clay such as
viscosity and film strength depend on the proportion of particles in the colloid
range. Thixotropy is generally influenced by the presence if ions of soluble
salts. Both these properties are influenced of amorphous silica. Another factor
of importance is the so called deflocculation curve of the clay, in which the
apparent viscosity is measured over a range of alkali additions. Clays which
show a minimum viscosity over a wide range of alkali addition give less
variation, in general, when used for holding up suspensions than a clay showing
a narrow maximum deflocculation range. On the other hand, clays with a
wide deflocculation range are frequently lignitic and, if the lignite content is
too high, they may cause surface defects in the enamel. Since the viscosity of
different clays can vary widely when tested at the same solid : water ratio, it is
obvious that in testing clays for use in a given enamel, different proportions of
different clays will be required and, although these properties may be adjusted
by the addition of suitable electrolytes, there are still other problems of surface
gloss, acid resistance, etc which may be affected. The amount of variation
possible in the percentage of clay addition is also dependent on the type of
enamel. The colour of a clay when fired is mainly determined by the sum of
the iron oxide and titanium content, assuming it is fired in an oxidising
atmosphere.
The rate of solution of clay in the enamel during melting has not been examined in detail. It appears to depend, as would be expected, on the grain size of the clay and on the SiO₂ : Al₂O₃ ratio, the silica being dissolved at a higher rate than the alumina. Its effect on acid resistance of the enamel appears to depend more on the alumina content than the silica.

All the essential data concerning the fundamental properties of the clays they supply are now available from the larger concerns. For example, so far as South Devon clays are concerned, Messrs Watts, Blake Bearne & Co Ltd, New Abbot, Devon are the largest producers, while Messrs Pike Bros. Fayle & Co Ltd, Wareham, Dorset are the largest producers of Dorset clays. Suitable enamelling clays are available from both groups, and both firms supply in great detail the chemical and physical constants of their various clays. In consequence, it is unnecessary for the enameller to make provision for carrying out such fundamental tests in his laboratory, and we may limit our consideration to the necessary control tests.

Currently, enamellers in the UK use Dorset clays quarried by ECC e.g. Hymod Prima, Hymod PKH, these are supplemented by Blue Clay imported from Germany and various speciality clays from the USA.

Editor.

Those following recommended are as follows;

**SAMPLING**

If the clay is not supplied shredded or pulverised, it should be coarsely powdered and approximately 5 lbs of sample obtained by the usual system of quartering. For test purposes the clay sample may be dried at a temperature of 100°C.

**VISCOITY OF AQUEOUS SUSPENSION**

Agitate 70 grams of clay with 1000ml distilled water (or multiples of these quantities) and measure apparent viscosity with torsion viscometer or Marriotte tube. Appreciable differences in this property in different batches of clay show differences in soluble salt content (usually sulphates) and in colloidal silica. By measuring the viscosity after vigorous agitation and then subsequent after vigorous agitation followed by two minutes standing, a measure of the
thixotropy of the suspension is obtained, which has an important effect on pick-up. The torsion viscometer should be used for this determination.

**EMPIRICAL TESTS FOR IMPURITIES**

Thoroughly agitate 100 grams of clay with 4 litres of distilled water in which has been dissolved 0.25 gram. sodium carbonate. Pass through 200 mesh (British) sieve. Wash the residue on the sieve under the tap, rubbing very lightly. Detach and dry the residue and weight it. The residue should be examined under the microscope or good magnifying glass.

Note: Black specks, fibre, lignite, magnetic iron.

Mix the residue with 50 ml of a white cover coat slip enamel and spray on to a ground coated panel (approx. 8” x 10”) and fire under standard conditions against a check sample. The specimen should show no blisters and not more than say 5 black specks, although the number is a matter of opinion.

**PICK-UP VALUE**

It is best to compare the effects of clays in this respect by using a suspension containing no electrolytes (except those in the clay), but it must be remembered that when a clay is incorporated in enamels of varying degrees of alkalinity or containing flocculants, the pick-up may be affected to a different extent with different clays, depending on their susceptibility to flocculation and deflocculation.

The simplest inert material to use is probably ground quartz. Mill additions may be checked as followed:

**a)** *For cover coat enamels*

1500 gram. quartz passing 200 mesh.
105 gram. clay
990ml water

Grind for 15 minutes on a small mill and adjust specific gravity to 1.6. Use two weighed ground coated steel plates having a _” hole in the corner for hanging purposes and dip them in the slip so as to provide inform coating on both sides; suspend vertically for one minute to drain; dry at 100°C and re-weigh. The weight of (dry) enamel adhering to the plate is calculated in grams per square ft. of plate area (both sides).
b) For ground coat enamels

1500 gram. quartz through 200 sieve.
75 gram. clay
990ml water

Otherwise the procedure is the same as above.

COLOUR

A 1000 gram. milling of a titanium enamel is made and three plates sprayed to controlled application weights. One plates is fired at the control temperature and the other two at 10°C on either side of the control temperature. A visual comparison of colour with samples is made using standard clay is then made.

LOSS ON IGNITION

About 1 gram of (dried) clay is ignited in a platinum crucible and the loss weight is determined.

This test often gives a useful clue as to whether a clay is being supplied with varying content of carbonaceous impurities, or that the actual clay substance is varying. (The latter will also be shown up by some of the tests previously described).

ACID RESISTANCE

Some producers carry out tests on acid resistance in standard enamel using different clays, but it is not felt that this test is justified as a routine control. It would certainly be done, however, when examining the qualities of a new clay.
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