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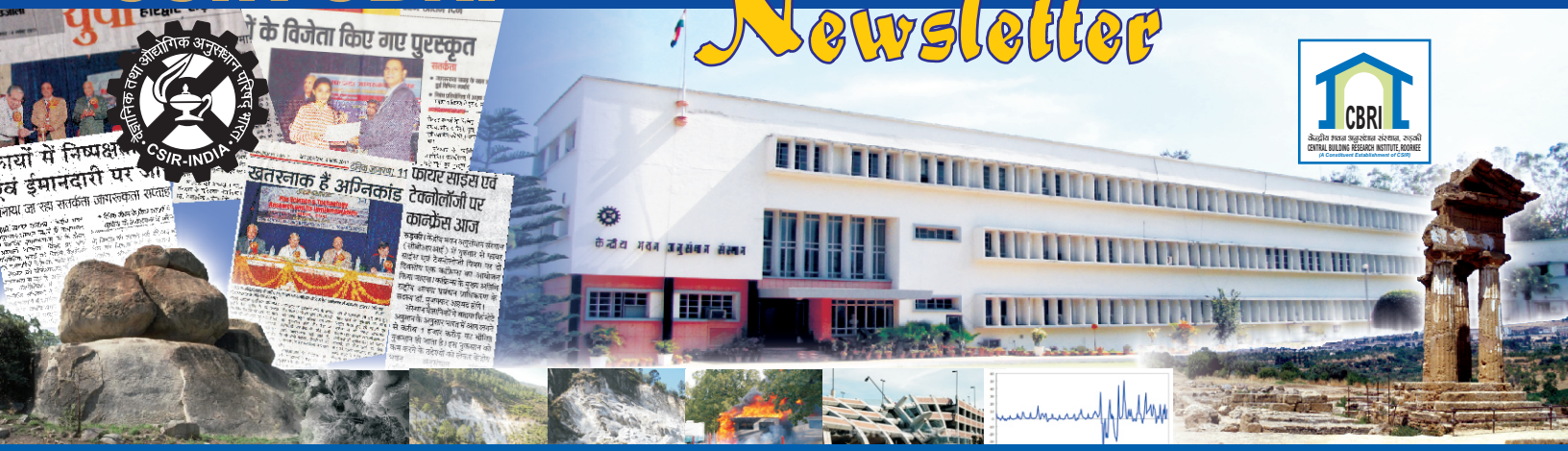
Newsletter



Volume-31
October – December 2011

Research in Progress

Synthesis and Characterisation of Nanosilica and its subsequent use in Calcium-Silicate Hydrate systems

Nanotechnology is gaining widespread attention and being applied in many fields to formulate materials with novel functions due to their unique physical and chemical properties. In the construction sector, nanotechnology is being used in a variety of ways to produce innovative materials. Using nanotechnology as a tool, it is possible to modify the nano/basic structure of the materials to improve the material's bulk properties such as mechanical performance, volume stability, durability and sustainability.

Dispersed, spherical particles of nano silica (n-SiO_2) with controllable size have been synthesised using a metal alkoxide, tetra ethoxysilane, as starting material and ammonia as base catalyst by sol-gel method. The particle size of nano silica can be well controlled by adding non-ionic surfactants. Increase in chain length of surfactant resulted in decreasing particle size of silica nano particles (Fig 1).

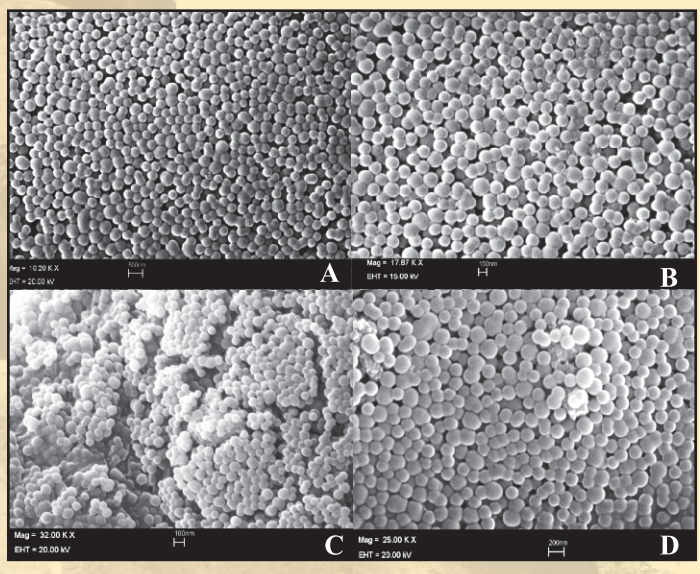


Fig 1: SEM micrograph of n-SiO_2 particles (80-200nm) prepared without surfactant (A), span 20 (B), span 40 (C) and span 60 (D).

Further, these nano-particles were incorporated in cement paste for compressive strength and calcium leaching resistant. The two silicate phases of cement, tricalcium silicate and dicalcium silicate, give calcium-silicate-hydrate (C-S-H) and calcium hydroxide (CH) as hydration products. The C-S-H gel being the main component of cement hydration is responsible for the strength and microstructure

In This Issue

of the cement paste. The amount of CH formation in cement paste was evaluated by thermogravimetric analysis (TGA) during hydration process. This was characterized by CH residue determination in cement paste admixture. Further, silica fume (SF) was also added to cement paste for comparison. TGA curves of pure, n-SiO_2 & SF incorporated cement pastes are shown in Fig 2 at 28 days of hydration.

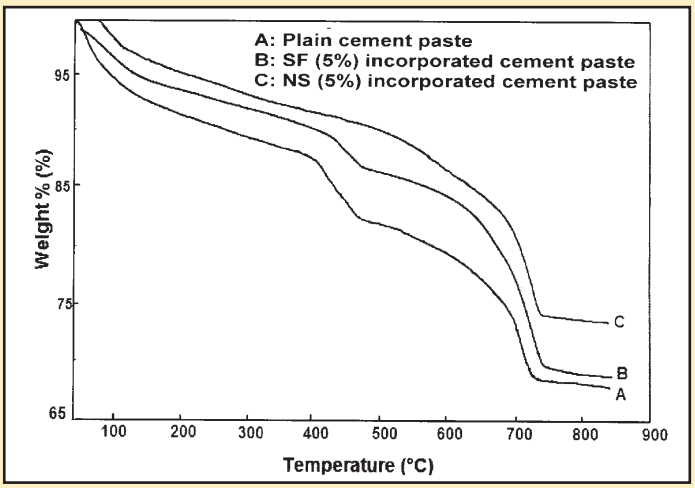


Fig 2: TG curves of cement pastes at 28 days of hydration

CH content in various cement paste during the hydration process is shown in Table 1. At early stage of hydration plain cement paste has 4.4% of CH whereas SF incorporated cement paste has 2.3% and n-SiO_2 incorporated paste has only 0.5% CH content. During the hydration, CH forms and at 3, 7 and 28 days it amounts to 7.7%, 12.8% and 20.3%, respectively in plain cement paste. Whereas the CH content, in SF incorporated cement paste is upto 16.3% at 28 days. n-SiO_2 have much significant effect as compared to plain and SF incorporated cement paste and at 28 days of hydration only 8.5% CH content was observed.

XRD profiles of plain cement, n-SiO_2 and SF incorporated pastes 28 days of hydration are shown in Fig 3, respectively. It is evident from XRD profiles that the CH peak is completely disappeared with the addition of n-SiO_2; while

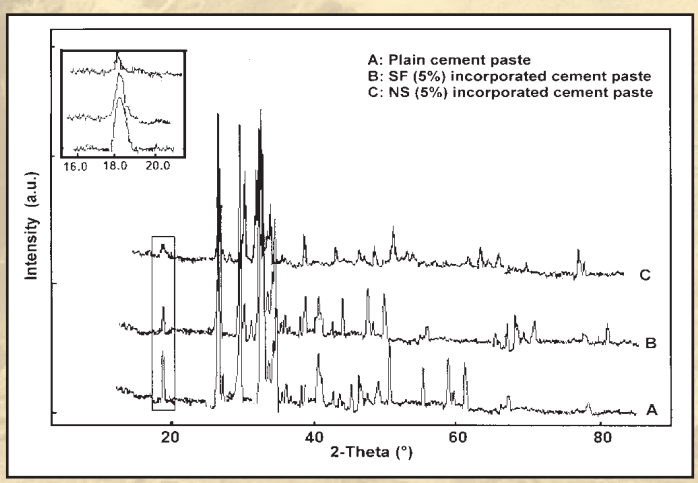


Fig 3: XRD patterns of cement pastes at 28 days of hydration

the same is significantly present in plain and SF incorporated cement paste. It is therefore inferred from Fig 3 that addition of n-SiO_2, significantly consumes the CH produced during the hydration process. Therefore, the pozzolanic reactivity of n-SiO_2 at early stage of hydration is significantly high and increases compressive strength at early ages, thereby enhancing the durability and mechanical properties of the cementitious materials.

SEM micrographs of plain cement paste, SF and with n-SiO_2 (5%) at 28 days are shown in Fig 4. It was observed that in the microstructure of the plain cement paste and SF incorporated cement paste, the C-S-H gel existed along with needle and plate shaped hydrates of CH. The deposited CH around the C-S-H gel is uniformly distributed among the entire cement phase (Fig 4). However, the microstructure of the cement paste with the addition of n-SiO_2 revealed that the formation of hydration products was denser, becomes significantly different and showing absence of the needle shaped crystals of CH.

Table 1 : Calcium hydroxide content (%) in cement pastes

	CH content (%) at			
	1 day	3 days	7days	28 days
Plain cement paste	4.4	7.7	12.8	20.3
Cement + SF (5%)	2.3	5.7	9.8	16.3
Cement + n-SiO_2 (5%)	0.5	3.3	5.2	8.5

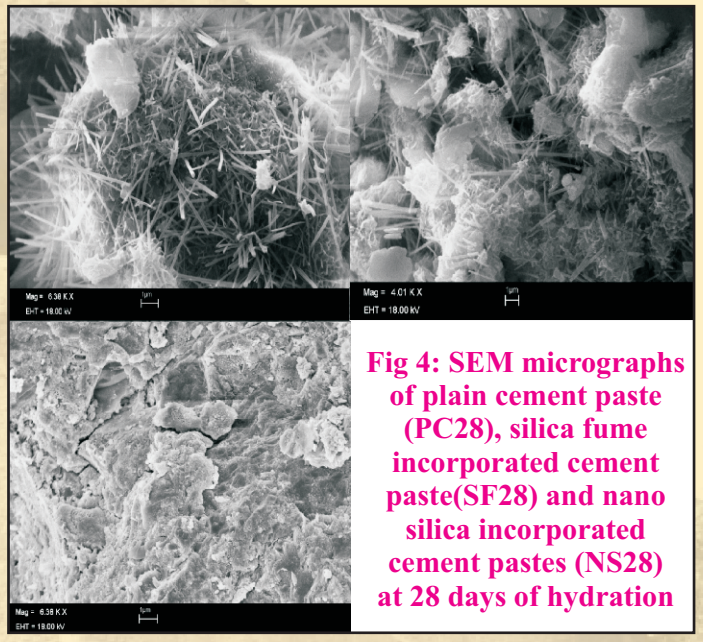


Fig 4: SEM micrographs of plain cement paste (PC28), silica fume incorporated cement paste(SF28) and nano silica incorporated cement pastes (NS28) at 28 days of hydration

The compressive strength of cement paste containing n-SiO_2 is shown in Table 2. The compressive strength of cement paste containing 5% n-SiO_2 is 64% higher at 1 day & 35% at 28 days than that of control cement paste. The difference in the strength development of the paste is attributed to the

Table 2: Mix proportions, compressive strengths of cement pastes

S. No.	$nSiO_2$(~100nm) in cement (%w/w)	Compressive strength (kg/cm^2)			
		1d	3d	7d	28d
1.	0.0 %	244	392	417	548
2.	0.2 %	269	433	482	585
3.	0.5 %	358	436	527	589
4.	1.0 %	364	459	535	592
5.	2.5 %	371	465	562	680
6.	5.0 %	401	528	581	741

pozzolanic reaction of n-SiO_2 with CH and forming additional C-S-H.

It was observed from SEM, XRD and TGA studies that addition of n-SiO_2 to cement reduced CH leaching by reacting at early stage of hydration and forming additional C-S-H gel and enhanced the mechanical strength. It was found that CH content in n-SiO_2 incorporated cement paste reduced 90% at 1 day and upto 59% at 28 days. Therefore, addition of nanoparticles significantly improves the engineering properties of the cementitious materials.

- L. P. Singh and Team

Cementitious Binder from MSW Incineration Ash

The disposal of municipal solid waste (MSW) incineration ash has become a significant economic and environmental issue. Recent investigations of MSW ash have focused more on environmental issues such as the leaching of heavy metals and other toxicological concern such as dioxins, but its resource is not utilized. The present research takes into an account both aspects which determined whether the cementitious binders can be used as a building material, and environmental aspects that may limit its use.

MSW incineration ash was ground to a sieve size of 170 µm for fly ash and 600 µm for bottom ash. The toxic elements such as mercury, chromium and cadmium in the fly ash and bottom ash were estimated by ICP - MS method. It is found that toxic elements in the fly ash are more than the bottom ash and also above the permissible limit of EPA. Removal of toxic elements was studied by washing with distilled water for the period ranging from 5 minute to 5 hrs. The pH is independent of the washing. Leaching of cadmium, lead, copper and chromium increased with increasing washing time. In acid wash, hydrochloric acid (HCl) is more effective than sulphuric and nitric acid under hydrothermal treatment. At 100^0 C, leaching of heavy metals are higher than at room temperature. TCLP analysis of fly ash and bottom ash was also carried out using water and HCl at 20^0 C and 100^0 C. It is found that acid wash at 100^0 C removed nearly almost Cr, Cd, Cu and K.

TGA analysis shows that weight loss in the fly ash and bottom ash is ~ 13% at 120^0 C and ~ 23% at 150^0 C indicating presence of organic / low volatile contents. XRD indicates presence of hump between 15 - 25.2-theta for fly ash whereas in this region there is no hump for bottom ash. SEM of fly ash and bottom ash was also carried out to know their surface morphology. Fly / bottom ash particles seems to be amorphous, irregular shape exhibiting deposition of substances contrary to the fly ash obtained from thermal power stations. After acid wash, particle seems to be smaller and rod shaped crystals are dominant in the microstructure.

A cementitious composition comprised of lime stone, calcium carbonate, MSW incineration ash, and small additives was prepared and fired at different temperatures (1250, 1350, 1400^0 C). The resulting mass was ground in a planetary ball mill. XRD results shows that the composition prepared at 1400^0 C exhibited nearly similar phases as cement (Fig.1). Prior to this, chemical and physical composition of MSW fly ash and bottom ash was

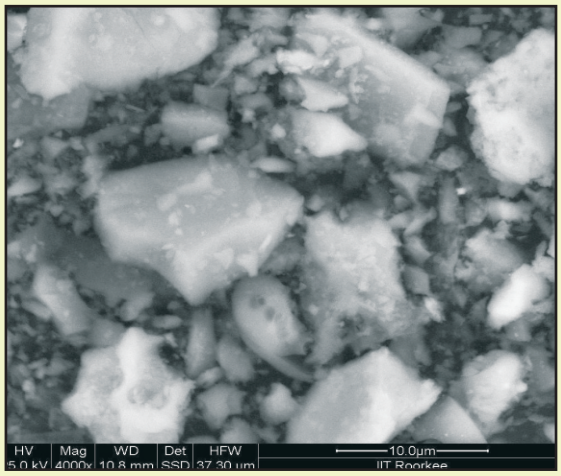
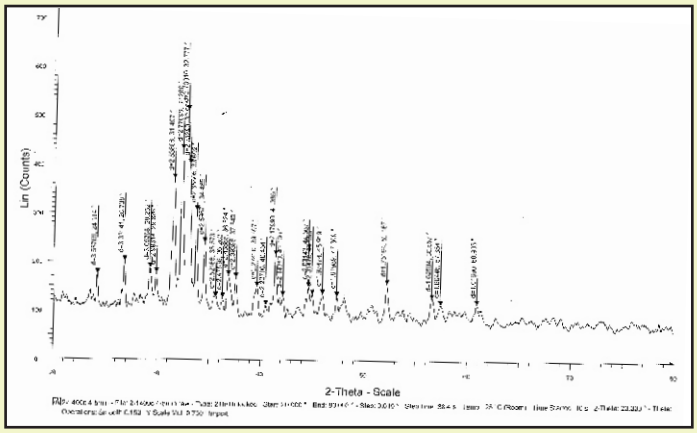
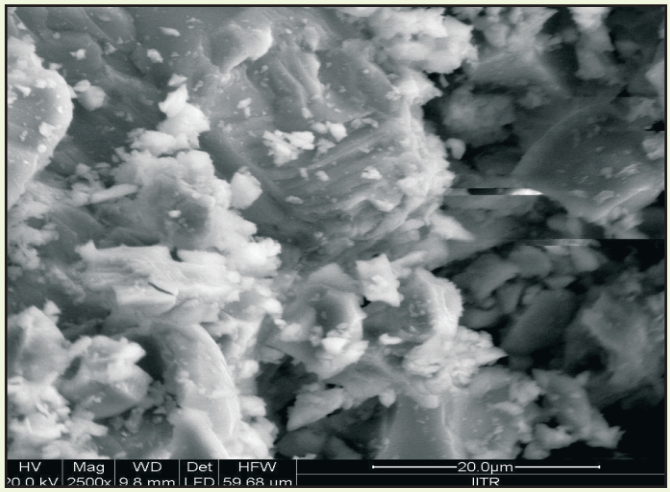


Fig. 1 XRD of cementitious binder based on MSW incineration ash



(a) MSW incineration ash



(b) MSW based binder

Fig.2 Cementitious binder from MSW incineration ash

carried out. The ash contains CaO 24.57%, Al_2O_3 6.26%, Fe_2O_3 3.57%, SiO_2 35.51%, MgO 3.31% and SO_3 0.75%. The loss of ignition was 19%. ICP analysis indicates that bottom ash has several heavy metals such as Cr 92.36 mg/kg, Cd 0.37 mg/kg, Pb 40.25 mg/kg, K 175.50 mg/kg. The chemical analysis of cementing materials was analyzed by XRF. The prepared binder has CaO content 55-60%, SiO_2 20-22%, Al_2O_3 6-7%, Fe_2O_3 4-4.71%, MgO 2.8-3.51%, SO_3 1.3-1.5%. The lime saturation factor was in the range of 0.75-0.88, Silica ratio 0.58-2, Alumina ratio 1.44-2.29, C_3S 34%, C_2S 33.57%, C_3A 9.25% and C_4AF 13.18%. It is found that C_4AF and C_2S were higher than the prescribed limit mentioned in the IS:269. SEM micrographs also show presence of various phases Fig. 2. The lime solubility curve indicates that the points are well below the line of saturation curve. Various cubes were also cast for measurement of their compressive strength. The properties of prepared binders were also compared with OPC. Work is under progress.

- Shilpa Agarwal, M. Gupta and B. Singh

Conference on Fire Science & Technology – Research and its Implementation

A two days Conference entitled "Fire Science & Technology–Research and its Implementation (FIRST 2011)" was organized during Nov 3-4, 2011 at CSIR-CBRI, Roorkee. The acrynom was very apt as it was the first conference of its type which related only to the scientific aspects of fire science. The conference was very well attended by delegates from CFEES (DRDO, New Delhi), IGCAR Kalpakkam, NPCIL, IIT Bombay and Delhi, SVNIT Surat, NIT Rourkela, Gitam University Vishakhapatnam, Jain University Bangalore, Kochi Airport besides indusrties such as Huntsman India and Balgium, Omega Elevators Ahmedabad, BASF Pune, L&T Chennai, Safety Control Devices Lucknow, Visaka Industries Hyderabad and ASKA Equipments New Delhi.

The conference was inagurated by Prof. I. M. Mishra, Dean Saharanpur Campus of IIT Roorkee and graced the occasion as chief guest while Prof. S. K. Bhattacharyya, Director, CSIR-CBRI, presided over the inaugural function. The proceedings of the conference and Divisional Brochure of Fire Engineering, were released in the opening ceremony. Prof. Bhattacharyya welcomed the delegates and informed them about activities carried out by CSIR as a whole and CBRI in particular. Dr. Sunil K Sharma, covener, informed that the conference has been organized with the objectives to bring together the researchers to deliberate upon the various facets of of FIRE HAZARDS and gave an overview and a bird's eye view of the five themes of the conference. In his inaugural speech, Prof. I.M. Mishra said that Fire Research Laboratory at CBRI is a unique facility of its kind in the country and appreciated the efforts of CBRI for organizing such a conference. He emphasised the need for systematic research in this area and credited CBRI for shouldering the responsibility. Dr. Rajiv Kumar, Organizing Secretary, conducted the programme and proposed vote of thanks. Later on Chief Guest and delegates visited an exhibition displaying fire fighting equipment out side the conference hall.

In all 34 papers were presented in the conference spread over five sessions, each devoted to a specific theme. First session on Fire Retardant Materials was chaired by Dr. Diane Daems of Huntsman (Europe) BVBA, BELGIUM who had come to India especially for this conference. In her keynote address she talked about use of steel, concrete and structural insulation panels as the typical building materials besides the use of SIPs and their fire characteristics particularly with reference to European standards. In all eight papers were presented in the session, four of which were related to Polyurethane foam.

Session on Extinguishment Technologies was chaired by Prof. J. C. Kapoor, Director, Amity Institute for Fire and Environmental Safety, Amity University, NOIDA. In his

keynote address he emphasized on use of nano technology. He talked about cement composites nano composites which are known to detect the presence of smoke, fire retardant nano technology using polymeric materials, use of Graphene as coating for fire retardancy and nano foams of exfoliated vermiculite for fire suppression. As a result of international ban on use of HALONS water mist technology has emerged as the most acceptable fire suppression agent in the recent times. Dynamics, efficacy and performance of water mist suppression system were presented by Dr. Meenakshi Gupta from CFEES (DRDO). Encouraging results have been obtained for using water mist system for fires in electronic equipments. Mr. R.S. Chimote from CBRI talked at length about design of clean agent fire extinguishing systems. It is no doubt that the water mist suppression system holds the key for future fire suppression technology being non toxic, non- polluting and environmental friendly.

Nine research papers were presented in the third session chaired by Prof. A.J. Shah, SVNIT, Surat on Fire Protection & Life Safety Technologies. In his keynote address Prof. Shah talked about use of steel in buildings and the flame resistant steel based on molybdenum. Results of experimental studies for improving fire safety in rooms with existing expanded polystyrene roof insulation was discussed by researchers from Jain University, Banglore. Technique for in-situ improvement of EPS insulation was proposed. Toxic effects of combustion products and their effect on occupants in a compartment fire were high lighted by Dr. Rajiv Kumar and Dr. Sunil Sharma, Scientists, CBRI. Mr. Padmanathan et. al. the research team from L&T Channai discussed the present trends in construction technology, norms of construction fire hazards and fire safety measures and have proposed a check list for next revision of national building code of India.

The fourth Session on Mathematical Modeling and Predictive Methodologies was chaired by Dr. A. K. Gupta, Former Head, FRL, CBRI. Dr. Gupta laid emphasis on use of mathematical modeling for designing safer buildings as well as planning for safe evacuation of occupants in case of a fire in his keynote address. He stated that while experimental validation is essential, planning of experiments should be done with utmost care otherwise it can lead to misleading conclusions. Various mathematical models; both zone and CFD type were discussed. These were related both to the real life situation such as escape (by Dr. P. K Yadav of CBRI) and forest fires (by. Prof. S. Chakraborty of NIT, Rourkela) and theoretical models such as effect of heat flux on stain less steel immersed in pool fire were discussed by Prof. Prabhu of IIT Bombay and very well appreciated by the audience.

Last session of the conference was on Case studies, chaired by Shri R. C. Sharma, Advisor, Delhi Fire Service, New Delhi. He talked about several real life fire situations involving polymeric materials supported by wonderful videos. Case studies related to air conditioners, electrical sub station were discussed by researchers from IGCAR, Kalpakkam. Dr. Suvir Singh from CBRI and Prof Shah from SVNIT Surat talked about commercial building fires and suggested remedial measures thereof.

The valedictory ceremony was held on 4th Nov, 2011, in which Shri Om Prakash, Fire Advisor, Government of India, was the chief guest. Shri M.P. Singh, Head, Fire Research Laboratory, CBRI, Roorkee, presided over the function. Dr. Sunil K. Sharma, Convener, read out the recommendations of the conference and requested delegates to give their comments. Dr. Rajiv Kumar, Organizing Secretary conducted the programme and proposed vote of thanks. The conference was rated as very high by one and all. There was a serious demand from all most all the delegates that it should become a regular feature preferably an annual one.

Vigilance Awareness Week

The Institute celebrated **Vigilance Awareness Week** during 31 October to 04 November 2011. Different programmes which include special lectures, Essay competition & poster competition for school children of staff wards, debate competition for staff members etc. have been organized during the week. The valedictory function was organized in the Institute's auditorium on November 04, 2011. Sri M.P.Singh, Chief Scientist, CSIR-CBRI presided over the function and Sri S. C. Sharma, Chief Engineer, IRI, Roorkee gave away the prizes to the winners of the different competitions. Dr. S.K. Saini, Sr Principal Scientist & Chairman, Organizing Committee presented a brief of the programme organized during the week and the function was concluded by a vote of thanks presented by Shri S.C. Tyagi, CoA.

CBRI signed MoU with DTRL

CSIR-CBRI has joined hands with Defence Terrain Research Laboratory (DTRL), a Defence Research & Development Organization (DRDO) establishment based in Delhi for the development of Landslide Early Warning System in Garhwal Himalaya. Prof. S.K. Bhattacharyya , Director CSIR-CBRI and Mr. G.S. Malik, Director, DTRL – alongwith both the Project Investigators ie. Mr. Y. Pandey (CSIR-CBRI) and Mr. Sunil Dhar (DTRL) signed the Memorandum of Understanding(MOU) on November 15th, 2011 at CSIR-CBRI, Roorkee.

CSIR-CBRI had been involved in landslide studies since last two and half decades in various Himalayan states with the financial support of DST, MoEF, BRO, DTRL and state PWDs. This will be the extension of mutual technical collaboration between both the premier institutions of the country which started in the year 2001 with the study of three strategic landslides in Sikkim.

A suitable project site Tangni landslide on Chamoli Joshimath road near Garudganga has jointly been selected by both the institutions and an instrumental study will be undertaken to arrive at a rainfall trigger threshold for initiation of landslides in this region. Real time monitored instruments like Piezometer, Inclinometer , Wire Extenso-meter and Autometic Rain-gauge will be deployed for site specific data collection. A suitable algorithm will be developed by the team so that the data received at remote stations be utilized for issuing multi level alarms for the benefit of civil administration as well as the general people. The project duration will be three years with the project budget of Rs. 45.50 lakh

Tangni landslide on Chamoli Joshimath Road

Signing ceremony of MoU at CBRI

CBRI signed MoU with UTU

Recognizing the importance of research and development in the areas of building science and technology and appreciating the need for creation of large reservoir of highly qualified manpower in all fields related to building science & technology and desiring to club their efforts by pooling their expertise and resources, CSIR-CBRI, Roorkee signed an MoU with Uttarakhand Technical University, (UTU) Dehradun on December 9, 2011. The Memorandum was signed by Prof S K Bhattacharyya, Director, on behalf of CSIR-CBRI, Roorkee and Prof. D.S.Chauhan, V.C., UTU, Dehradun.

MoU details the modalities and general conditions regarding collaboration between CSIR-CBRI and UTU Dehradun for enhancing within the country, the availability of highly qualified manpower in the area of building science & technology without any prejudice to prevailing rules and regulations in CSIR-CBRI and UTU and without any disregard to the mechanism evolved and approved by the competent authorities under Govt. of India in so far as such mechanism applies to CSIR-CBRI and UTU. The areas of cooperation can be extended through mutual consent. The duration of the MoU shall remain effective for a period of five years.

Signing ceremony of MoU at Dehradun

Deputation Abroad

As a friendly gesture, the Government of India has committed to help Maldives in its problem of acute shortage of technical manpower and unemployment among Maldivian youth. The commitment of the Govt of India is to assist the Govt of Maldives by providing technical support to the Maldivian 'Special Project on Training and Employment' to be implemented by Ministry of Education, Department of Higher Education, Govt of Maldives. Under the programme about 1,500 youth are to be trained in various vocations of building construction.

Research and Information System (RIS), Ministry of External Affairs, Govt of India, New Delhi identified CSIR-CBRI Roorkee to shoulder this responsibility. RIS is India's 'Think-Tank' on global issues in the field of international economic relations and development cooperation. RIS functions in close association with various governmental bodies, research institutions, academicians, policy-makers, business and industry circles in India and abroad.

Shri SG Dave, Chief Scientist and Shri H K Jain, Principal Technical Officer were therefore, deputed to Maldives from December 17 to 20, 2011 to assess the ground situation and discuss training requirements of building artisans at Maldives. This would help both sides in framing tailor-made training modules for trainers and trainees with direct impact on human resource development at craftsman level in the construction sector in Maldives.

The visit was planned by the Indian High Commission, Maldives. Meetings were held with Dr. Ahmed Ali Manik, Minister of State of Education, Govt of Maldives, Vice Chancellor, National University of Engineering and Technology, Chief of Staff and Economic Advisor at the President's House, Mr. Zubair Muhammad, Chief Executive Officer, Maldives Polytechnic, Mr. Mohammad Ali Janah, President, Maldives Association of Construction Industry (MACI), CEO, Alysen Services Pvt Ltd., Rashid Carpentry and Construction Company, Mr. DL Venu Gopal, Dy Gen Manager, NBCC India, Mr. Subramanyam, GMR and Mr. DM Mulay, High Commissioner of India. Mr. PS Karthigeyan, First Secretary, Political and SAARC, High Commission of India coordinated the meetings and was personally present in all the meetings. This helped in understanding the training requirements as visualized by the Maldivian Government, as expected by the construction industry and as perceived by the Maldivian society.

The visit provided a deep insight into the training needs of the country and would help a great deal in formulating a realistic proposal and effective Training Modules.

Colloquium

16th November 2011, Production of Training Videos for use under CSIR 800 RSWNET Programme
Shri H. K. Jain, Principal Technical Officer, CSIR-CBRI

23rd November 2011, Ferrocement Works in India
Dr. B. N. Divekar, President , Ferrocement Society, Pune

30th November 2011, New Purchase Procedure 2008 and Material Management Module for ERP Implementation
Shri S. P. Singh, Store & Purchase Officer, CSIR-CBRI, Roorkee

14th December 2011, Nanotechnology in Performance Enhancement of Cement Based Materials
Dr. L. P. Singh, Senior Scientist , CSIR-CBRI, Roorkee

21st December 2011, Earthquake Induced Soil Failure Liquefaction: Hazards, Prediction and Remediation
Shri Manojit Samanta, Scientist, CSIR-CBRI, Roorkee

Research Papers Presented

1. Flammability performance of rigid polyurethane foam: use of different blowing agents, Harpal Singh, Sunil K. Sharma, A. A. Ansari, Rakesh Kumar and M. P. Singh, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 24-34.
2. Effect of fire retardants on generation of smoke and toxic combustion products, N. K. Saxena, Sunil K. Sharma & Sushil Kumar, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 35-43.
3. Fire propagation index & heat release studies of plywood treated with chemical surface barrier, A. A. Ansari, Sunil K. Sharma, Harpal Singh and Rakesh Kumar, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 44-55
4. Toxic species in compartment fires, Rajiv Kumar, M.P. Singh, Sunil K. Sharma and Sushil Kumar, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 95-103
5. Visibility of photoluminiscent fire exit signs: An experimental studies, M. P. Singh, A. A. Ansari, Shorab Jain, N.S.Tyagi, Sushil Kumar and Rakesh Kumar, proceedings of conference on 'Fire Science and Technology-Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 104-111
6. Study on deterioration of visibility due to smoke for some materials used in railway industries, A. A. Ansari, M. P. Singh, Sourabh Jain and Rakesh Kumar, proceedings of conference on 'Fire Science and Technology-Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 140-145
7. Performance based fire safety design: Estimation of movement time for evacuation using evacnet-4, Jawad Farooqui, Shorab Jain, Shashi, Surendra Kumar, M. P. Singh, proceedings of conference on 'Fire Science and Technology-Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 146-160
8. Design of clean agent fire extinguishing system as per nfpa 2001 standards with respect to fire hazard scenarios in India, R.S. Chimote, Shashi, Surendra Kumar and Reshu Sharma, proceedings of conference on 'Fire Science and Technology-Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 190-212
9. A model for determining optimal required safe evacuation time of a building during fire, Pradeep Kumar Yadav, Rajeev Kumar Sharma, Sunil K Sharma, Rajiv Kumar, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 215-225
10. Effect of fire exposure to a semi-infinite plate on unexposed surface temperature, B. M. Suman and Sandeep Kumar, proceedings of conference on 'Fire Science and Technology-Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 258-264
11. Performance based fire safety design : prediction of untenability conditions in assembly hall and corridor using zone and CFD modeling, Shorab Jain, M. P. Singh and A. A.

Ansari, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 276-288

12. Fire in Business Buildings- A case study, Suvir Singh, S.K. Singh and Ajay Chourasia, proceedings of conference on 'Fire Science and Technology- Research & its Implementation', CSIR-CBRI, Roorkee, 3rd-4th November 2011, pp 327-334
13 A comparison of ANFIS and ANN for the prediction of Peak Ground Acceleration in Indian Himalayan Region, Abha Mittal, D.P. Kanungo and Shaifaly Sharma, Conference on Soft Computing for Problem Solving, 20-22 Dec. 2011, Institution of Engineers, IIT, Roorkee

Invited Lecture

Dr SR Karade, Principal Scientist, delivered a lecture on Evaluation of Corrosion in Reinforced Concrete Structures in a Short Term Course on "Testing of Concrete in Structures" organised at Continuing Education Centre, IIT Roorkee during December 19-23, 2011.

Paper Published

B.M. Suman, Energy Simulation of a Single Zone Building Determining Indoor Air Termperature, International Transaction in Mathematical Sciences and Computers, Vol.4, No. 2, July-Dec., 2011, 231-242.

Workshop Attended

1. Dr SR Karade, Principal Scientist attended a Workshop on 'Service Life Design of Concrete Structures' during 14-15 Nov., 2011 organised by Indian Concrete Institute (ICI) and the International Federation for Structural Concrete (fib) at India Habitat Centre, New Delhi.
2. Dr SR Karade, Principal Scientist attended Indo-Norwegian Workshop on Potential for Increased Use of Mineral Wastes in Cement and Concrete on 20 December 2011at New Delhi.

Staff News

Awards

Shri Umesh Bhatnagar, Technician (53+ age group) participated in Airtel Delhi Half Marathon (International) Competition on 27 November 2011 at Jawaharlal Nehru Stadium Delhi and won the prizes (Finisher Medal & Timing Certificate) in International Marathon race of 22 kms.

Promotion

Sh. Satyarth Prakash	Asstt.(F&A), Gr-I	28-12-2011
Smt. Rubina Zaidi	Asstt. (F&A), Gr-I	30-12-2011

Superannuation

Sh. Vinod Kr Sharma	Sr. Principal Scientist	31.10.2011
Sh. Suresh Kr Sharma	Principal T.O.	31.10.2011
Sh. Prem Lal	Sr.Technician-2	30.11.2011
Sh. Naval Singh	Sr. Technician-2	30.11.2011
Sh. Chottey Lal	Sr. Technician-2	30.11.2011
Sh. Deepak Chopra	Sr. Technician-2	30.11.2011
Sh. Hamir Dass	Lab. Asstt.	30.11.2011
Sh. S.C. Tyagi	COA	31.12.2011
Dr. S .K. Saini	Sr. Principal Scientist	31.12.2011
Sh. S.K. Srivastava	Principal T.O.	31.12.2011
Sh. Nan Kanwar	Sr. Technician-2	31.12.2011
Sh. C.P. Tyagi	Jr. Steno	31.12.2011

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