UNIVERSITÀ DEGLI STUDI DELL'AQUILA

DICEAA - Dipartimento di Ingegneria Civile, Edile-Architettura ed Ambientale

Seminar announcement

May the 8th, Tuesday, 11.00 – 12.00, Roio, Aula B+1.4

NANOTECHNOLOGY AND SUSTAINABILITY IN CONCRETE CONSTRUCTION

by

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Super tall buildings such as one kilometer high Kingdom Tower are constructed with concrete as a structural material. Such tall buildings are made with so called high performance concrete, which can have strength 5 times that of conventional concrete. The development of high strength concrete is a result of our understanding of particle packing, rheology and microstructure engineering. Concrete is a critical material for infrastructure; the world wide consumption of concrete is about 2 tons for every living human being. However, its continuing use will require improving its sustainability. Nanotechnology is playing an increasing role in making concrete more sustainable. One approach to making concrete more sustainable is to replace portland cement (and its significant carbon foot print) with fly ash, a waste material from burning coal. When fly ash is replaced with portland cement,the rate of strength development slows down which is not desirable . Addition of nano particle such as nano silica accelerates the chemical reaction by providing nucleation sites. In addition, characterization of nano structure of calcium silicate hydrate by nano indentation, AFM, FTIR and NMR shows beneficial nano scale modification. Manipulation of concrete rheology has been a key to make concrete more constructible. The viscosity should be sufficiently small so that concrete can be pumped a great distance, but the material should be thixotropic to reduce the pressure on form work. Addition of a small amount of nano clay has been shown to accelerate the rate of thixotropy. Rheology of aging colloidal suspension is being studied by computation modeling as well as by measuring the dimensions of flocculated particles by using laser spectrometer.Concrete is a brittle material, prone to cracking. Concrete structures are reinforced by see bars at a millimeter scale.However, flaws in cement paste are in nano scale. To reinforce concrete at nano scale addition of carbon nano tube is studied. The key challenges include dispersion and rheology. Recent studies have demonstrated that adding a very small amount (0.05%) of well dispersed CNT has a profound effect on performance: mechanical properties, piezo-resistivity, transport properties as well as corrosion reinforcing steel. Such multi functionality is probably related to altered nano structure of concrete.

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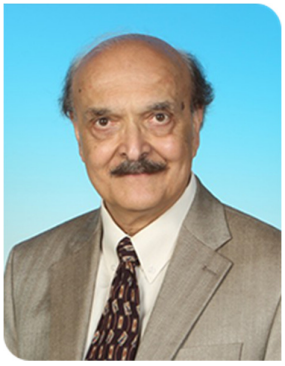

He has been Director of the Center for Advanced Cement-Based Materials; Coordinator, Graduate Program Structural Engineering, Department of Civil and Environmental Engineering, Northwestern University; Director of the Center for Concrete and Geo-materials, Northwestern University; Director of the Graduate Program, Department of Materials Engineering, University of Illinois, Chicago.
He is consultant for several industrial companies in U.S. and abroad: Lafarge, France; U. S. G., Des Plaines, Illinois; Wiss, Janney, and Elstner, Northbrook, Illinois;Holderbank Management, Ltd., Switzerland; Corning Glass Works, Corning, New York; Portland Cement Association, Skokie, Illinois; Design Engineer, Modjeski and Masters, Harrisburg, Pennsylvania.
HONORS AND OTHER PROFESSIONAL ACTIVITIES: Member, National Academy of Engineering; Foreign Member, Chinese Academy of Engineering; Fellow, Indian Academy of Engineering; Distinguished Professor, IIT, Madras; Honorary Professor,Tongji University Member,Institute of Advanced Studies,HKUST; NAE Liaison Committee;NAS Panel to evaluate NIST Building and Fire Research; Honorary Member, American Concrete Institute; Honorary Member, The International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM); Member, Institute of Advanced Studies,Hong Kong University of science and technology; Distinguished Lecture Series, University of California, Los Angeles, University of Illinois, Chicago, Vanderbilt University, Iowa State University; Honorary Professor Nanjing Technical University Tongji University and Dalian, Maritime University; Fulbright Award, Indian Institute of Technology, Mumbai; and IIT Madras; Distinguished Professor,Indian Institute of Technology, Madras; Elizabeth D. Rockwell Engineering Lecture; University of Houston Della Roy Lecture, American CeramicSociety, Detroi; Frank E. Richart Distinguished Lecture, University of Michigan; Named to the "Top Ten Most Influential Persons in the Concrete Industry," by Concrete Construction, 2006; Robert E. Philleo Award, American Concrete Institute, Concrete Research Council, Conference Dedication and Special Award, 6th RILEM Symposium on Fiber-Reinforced Concretes (FRC) – BEFIB, Varenna, Italy; Honorary Professor, Department of Civil and Structural Engineering, Hong Kong Polytechnic University; Honorary Symposium, Celebrating Concrete: People and Practice, Conference Dedication and CTU Award, University of Dundee. Scotland; American Concrete Institute, Honorary Symposium- Concrete: Material Science to Application, A Tribute to Surendra P. Shah; The Richard J. Carroll Memorial Lectureship, Johns Hopkins University; American Concrete Institute, Illinois Chapter, Henry Crown Award; American Concrete Institute, Arthur R. Anderson Award to ACBM Center; Charles Pankow Award for Innovation (Collaborative Work with W.R. Grace and ARCO); American Society of Civil Engineers, Civil Engineering Research Foundation, 1997; Engineering-News Record (ENR) Newsmaker Award; Swedish Concrete Award; Walter P. Murphy Professor of Civil Engineering Arthur R. Anderson Award, American Concrete Institute; Sanford E. Thompson Award, American Society of Testing and Materials (ASTM); RILEM Gold Medal Award; Teaching Excellence Award, CE students; Distinguished Visiting Professor, National University of Singapore; Alexander von Humboldt Fellowship Award for Distinguished Senior Scientist; NATO Visiting Senior Scientist to Turkey; Guest Professor, Denmark Technical University; Guest Professor, Delft University of Technology, Delft, The Netherlands; Consultant to NATO Science for Stability Program; Visiting Professor, University of Sydney; NATO Visiting Senior Scientist to France; Member of the Evaluation Team of Danish Research Groups in the field of Concrete; UNIDO Consultant to People's Republic of China; UNESCO Expert to India; Member, Editorial Board, ASCE Journal of Civil Engineering Materials; Member, Editorial Board, Journal of Ferro-Cement; Member, Editorial Board, RILEM Journal of Materials and Structures; Editor-in-Chief, Concrete Science and Engineering; TECHNICAL COMMITTEES: Transportation Research Board, Task Force on Nanotechnology; NAE Liaison Committee;NAS Panel to evaluate NIST Building and Fire Research; ACI- 215 Fatigue of Concrete; ACI- 236 Material Science of Concrete; ACI- 237 Self-Consolidating Concrete; ACI- 231 Properties of Concrete at Early Ages; ACI- 440 Fiber Reinforced Polymer Reinforcement; ACI- 544 Fiber Reinforced Concrete; ACI- 548 Polymers in Concrete; ACI- 549 Thin Reinforced Cementitious Products and Ferro-Cement; Member, Transportation Research Board Task Force on Nanotechnology; Member, Bureau, RILEM; Chair, Advisory Committee, Engineering Mechanics Division, ASCE; Chairman, Executive Committee, Engineering Mechanics Division, American Society of Civil Engineers; (1996-1997); Chairman, Properties of Concrete, Transportation Research Board; Member, National Initiative on High-Performance Concrete; Member, Materials Research Council, American Concrete Institute; Member, Management Advisory Board, RILEM; Member, Advisory Committee on Cement and Concrete, Strategic Transportation Research Study, Chairman, RILEM Committee on Strain-Softening of Concrete; Chairman, RILEM Committee on Fracture of Concrete; Chairman, Fiber Reinforced Concrete, American Concrete Institute; Vice Chairman, Fracture of Concrete and Rock, Society of Experimental Mechanics; Member, High Strength Concrete, American Concrete Institute; Member, Ferrocement, American Concrete Institute; Member, Fracture Mechanics, American Concrete Institute; Member, Polymer Concrete, American Concrete Institute; Chairman, Fatigue of Concrete Structures, American Concrete Institute; President, Chicago Chapter, American Concrete Institute; Chairman, Properties of Materials, Engineering Mechanics Division, American Society of Civil Engineers; Member, Ad Hoc Committee on Ferro-Cement for Developing Countries, National Academy of Sciences.