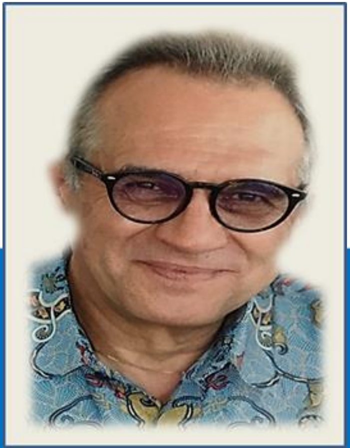


Nanotecnología en Concretos. Experiencias en Asia

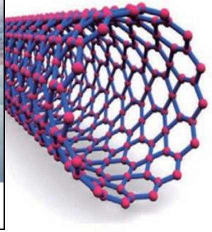
Víctor A. Rodríguez - Concreto Virtual

Patrocinado por el

CAMPA INDUSTRIAS + Academia Técnica CADCO

Septiembre 25, 2020

Student Chapter




CONCRETO
MENU

NOTICIAS

Lanzan aditivo para concreto en base a grafeno

Empresa española Graphenano entra al mercado de aditivos con línea de siete productos.

SMART ADDITIVES
MECHANIC PRECAST HARD SUPPORT
DRY OUTSITE FINISH

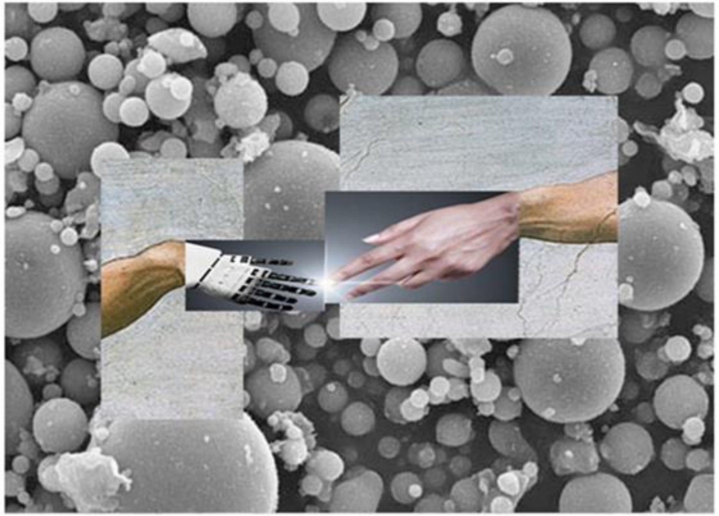
La empresa española Graphenano Smart Materials anunció el lanzamiento de una línea de aditivos para hormigón hecha en base a grafeno, el nanomaterial producto de átomos de carbono que tiene resistencia y dureza superiores al acero y al diamante.

De acuerdo con la compañía, la línea Smart Additives es la primera a utilizar grafeno en aditivos de concreto. La idea, según Graphenano, es producir "hormigones 2.0", que sean más resistentes y posibiliten construir estructuras que duren hasta 50 años más que los convencionales, dados los mismos niveles de mantenimiento.

NANOTUBOS DE CARBONO EN EL HORMIGÓN. Un nanotubo es el material resultante de agrupar una lámina de carbono en forma de cilindro. Su adición en pequeñas proporciones al hormigón confiere a este material un aumento de la resistencia de hasta 50 veces y la adquisición de propiedades piezorresistivas. De este modo se podrían obtener elementos estructurales autosensitivos, es decir, elementos estructurales que por sí mismos nos proporcionarían información cifrada sobre su estado tenso-deformacional, sobre su estado de conservación y sobre posibles necesidades de actuación preventiva.

SENSORES MAGNÉTICOS Y "HORMIGÓN INTELIGENTE": Los trazadores magnéticos embebidos en el cemento, capaces de emitir una señal única identificable, permitirán el desarrollo de cementos inteligentes que aporten al usuario información en tiempo real sobre su tipología, procedencia y prestaciones.

La utilización de hormigones con estos materiales de cambio de fase PCMs en edificación con el objetivo de almacenar energía, en combinación con sistemas de gestión basados en la inteligencia artificial, TICs y Big Data que tengan en cuenta la disponibilidad de energías renovables, el coste de dicha energía, la predicción meteorológica y el comportamiento del usuario, permitirá gestionar la demanda del edificio utilizando estrictamente energías renovables y estabilizar la red eléctrica, minimizando la necesidad de nuevas inversiones en materia de generación.



“Estamos al comienzo de una ola de avances”: David A. Lange

+ محمد

1. **Nanotecnología en Concretos**
    - Nanotecnología de Materiales
        - Materiales Cementicios / Nanopartículas (Aditivos para Concreto)
        - Nano-Aditivos para Concreto / Activación Mecano-Química
    - Dilemas y Expectativas

2. Proyectos Constructivos en Asia
    - Consideraciones Técnicas
        - Ensayes en Obras / Normativas
    - Consideraciones Industriales
        - Manufactura / Transportación / Colocación

3. Preguntas y Respuestas

2 OPERACIONES DE UNA CONCRETERA SUSCEPTIBLES DE AUTOMATIZACION

ING. VICTOR ANTONIO RODRIGUEZ VALENCIA

I. INTRODUCCION.

EN LA ACTUALIDAD EXISTEN MUCHAS ACTIVIDADES QUE YA NO PUEDEN LLEVARSE A CABO SIN EL EMPLEO DE UN SISTEMA DE COMPUTO. EL USO DE COMPUTADORAS EN ALGUNAS DE ESTAS ACTIVIDADES ES CONOCIDO POR TODOS NOSOTROS; EN OTRAS MAS, TAL VEZ NI NOS IMAGINAMOS QUE ESTO PUEDA EXISTIR.

BASTA CON ANALIZAR RAPIDAMENTE EL MEDIO QUE NOS RODEA PARA DETECTAR AQUELLAS ACTIVIDADES EN LAS QUE TUVO QUE VER ESE PEQUEÑO GIGANTE LLAMADO MICROPROCESADOR.

SUPONGAMOS QUE AL TERMINAR ESTE SEMINARIO DECIDIMOS IR A UN SUPERMERCADO PARA COMPRAR AQUELLO QUE TOMAREMOS EN NUESTRA CENA.

3

AL ESTAR FORMADOS EN LA LINEA DE ESPERA DE LA CAJA REGISTRADORA DEL SUPERMERCADO, SEGURAMENTE VEMOS QUE LA MAQUINA REGISTRADORA YA NO ES AQUEL ARMATOSTE QUE VEIAMOS HACE 10 AÑOS, SINO QUE AHORA ES UNA PEQUEÑA TERMINAL DE UNA COMPUTADORA CENTRAL LA CUAL LLEVA EL REGISTRO INVENTARIADO DE TODO LO VENDIDO EN EL DIA PARA SU REPOSICION. ADEMAS DE CALCULAR EL IMPORTE DE LO COMPRADO Y LOS IMPUESTOS CORRESPONDIENTES. EN ESTADOS UNIDOS YA ES COMUN EL USO DEL CODIGO UNIVERSAL DE PRODUCTO, EL CUAL PRONTO VEREMOS EN MEXICO, QUE AGILIZA LA OPERACION DE REGISTRO DE MERCANCIA COMPRADA A TRAVES DEL USO DEL RAYO LASER QUE TRANSMITE LA INFORMACION CONTENIDA EN EL CODIGO UNIVERSAL DE PRODUCTO A LA CAJA REGISTRADORA COMPUTARIZADA.

SI EL PAGO LO EFECTUAMOS CON UNA TARJETA DE CREDITO, LO PRIMERO QUE HACE LA CAJERA ES VERIFICAR EN UN LISTADO DE COMPUTADORA SI NO ESTA CANCELADA NUESTRA TARJETA O SI NO HEMOS EXCEDIDO EL LIMITE PERMITIDO DE CREDITO. SI TODO ESTA CORRECTO, FIRMAREMOS UN COMPROBANTE DE COMPRA QUE POSTERIORMENTE SERA PROCESADO POR UNA COMPUTADORA, PARA QUE EN EL CASO DE NO PAGAR A TIEMPO SE NOS CALCULEN LOS MODICOS INTERESES QUE TENDREMOS QUE PAGAR.

4 AL SALIR DEL SUPERMERCADO NOS DIRIGIREMOS CON TODO Y LAS MERCANCIAS QUE HAYAMOS COMPRADO A NUESTRO MODESTO AUTOMOVIL, EL CUAL TAL VEZ YA FUE ENSAMBLADO O PINTADO POR UN ROBOT EN LA PLANTA DE PRODUCCION. SI
5 TENEMOS GUSTOS MAS REFINADOS, EL AUTOMOVIL TENDRA UN PANEL GRAFICO DE INSTRUMENTOS QUE NOS INDICA DIGITALMENTE CON COLORES OPTICOS, LA VELOCIDAD Y LAS TEMPERATURAS DEL AGUA Y EL ACEITE, ENTRE OTRAS MONERIAS; ADEMAS DE ACATARRARNOS CON SUS MENSAJES COMPUTARIZADOS COMO EL DE "FAVOR DE ABROCHARSE EL CINTURON DE SEGURIDAD" O EL DE "NO OLVIDE SUS LLAVES", LO CUAL POR LA LEY DE MURPHY TERMINAREMOS POR HACER.

11

PROGRAMACION Y SUPERVISION DE UNIDADES REVOLVEDORA.

EXISTEN EN EL MERCADO VARIOS PROGRAMAS QUE PERMITEN PROGRAMAR Y SUPERVISAR LAS UNIDADES REVOLVEDORA. ESTOS, SISTEMAS PERMITEN A UN SOLO DESPACHADOR SUPERVISAR CONSTANTEMENTE TODAS LAS UNIDADES REVOLVEDORA EN TODAS LAS PLANTAS ELIMINANDO CON ELLO TODO EL MANEJO DE PAPELEO NECESARIO. EL SISTEMA PERMITE LLEVAR REGISTRO DEL TRAFICO PARA CADA PLANTA, LAS ENTREGAS ESPECIFICAS EN CADA OBRA, POSICION DE CADA UNIDAD REVOLVEDORA, PROGRAMAR CON EL TIEMPO MAS TEMPRANO DE ARRIBO CONTANDO CON UNA ALARMA CUANDO LA ENTREGA ESTA RETRASADA. LOS TIEMPOS EN LLEGAR AL DESTINO, ESPERA PARA DESCARGA, DESCARGA Y REGRESO A LA PLANTA CON UNA ALARMA CUANDO EL REGRESO SE ESTA RETRASANDO. INVENTARIO DE UNIDADES REVOLVEDORA DISPONIBLES, ENTRE OTRAS COSAS.

12

PARA EL MANEJO DE ESTE SISTEMA ES NECESARIO DE LA RETROALIMENTACION DE LA POSICION QUE GUARDA CADA UNIDAD REVOLVEDORA. EXISTEN OCHO POSICIONES DEFINIDAS, LAS CUALES SON:

1. CARGANDO EN LA PLANTA
2. EN CAMINO A LA OBRA
3. LLEGADA A LA OBRA
4. DESCARGA EN LA OBRA
5. LAVADO DE LA UNIDAD EN LA OBRA
6. DE REGRESO A LA PLANTA
7. EN ESPERA EN LA PLANTA PARA SURTIR OTRO PEDIDO
8. FUERA DE SERVICIO

ESTE SISTEMA NOS PERMITE OBTENER REPORTES DE LA ACTIVIDAD DE CADA UNA DE LAS UNIDADES REVOLVEDORAS, CON EL FIN DE ANALIZAR SU PRODUCTIVIDAD, ASI COMO EL SUMINISTRO DE CONCRETO POR CADA OBRA ESPECIFICA. ADEMAS, PUEDE UTILIZARSE PARA PROGRAMAR EL SERVICIO DE LUBRICACION, EL MANTENIMIENTO PREVENTIVO, ENTRE OTRAS COSAS.

13 Otros sist

DOSIFICACION DE CONCRETOS. 14 15

ESTE SISTEMA EXISTENTE EN EL MERCADO NOS PERMITE CON LA AYUDA DE UN SERVOMECANISMO LA DOSIFICACION DE CONCRETOS EN CADA UNA DE LAS PLANTAS. LA FORMA EN QUE FUNCIONA ESTE SISTEMA ES TENIENDO UN CEREBRO ELECTRONICO QUE CONTROLE LAS BASCULAS, COMPUERTAS DE LAS TOLVAS Y BANDAS TRANSPORTADORAS POR MEDIO DE MECANISMOS CONECTADOS A ESTE CEREBRO ELECTRONICO. LA CONSOLA DE OPERACION TIENE UN TECLADO EN DONDE ESTAN TODAS LAS FUNCIONES QUE EL PESADOR PUEDE REALIZAR. EN LA PANTALLA SE MUESTRAN LAS CANTIDADES DE MATERIAL EXISTENTES EN LOS SILOS, DEPOSITOS, TOLVAS, ASI COMO EL FUNCIONAMIENTO DE LAS BANDAS, EL NOMBRE DE LA CONSTRUCTORA Y UBICACION DE LA OBRA, CON LAS CARACTERISTICAS DEL CONCRETO SOLICITADO.

16

ESTE SISTEMA EVITA ERRORES POSIBLES EN LA DOSIFICACION DE LOS CONCRETOS SUMINISTRADOS, MANTIENE REGISTRO DE TODOS LOS CONCRETOS SURTIDOS LO CUAL NOS DA UNA SUPERVISION ADICIONAL DE LOS INVENTARIOS DE LAS MATERIAS PRIMAS. IMPRIME LAS REMISIONES DEL CONCRETO DOSIFICADO, Y PERMITE MANTENER DENTRO DE HORARIO TODOS LOS SUMINISTROS

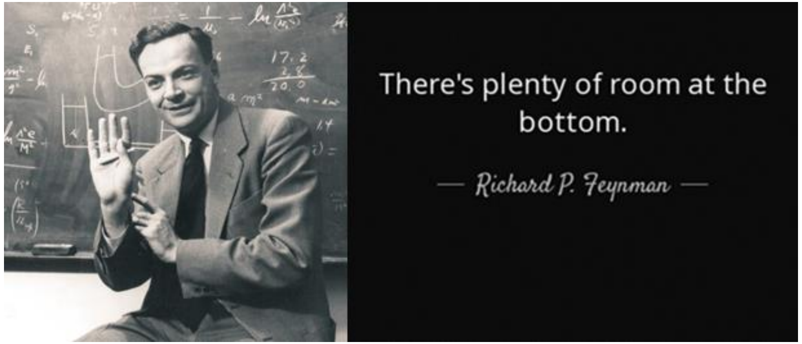
Nanotecnología de Materiales

- **Fundamentos de Nanotecnología: R. Feynman / ACI 241R-17 / K. Sobolev**
- Opciones actuales: Materiales Cementicios / Nanopartículas (Aditivos para Concreto)
- Complementariamente: Nano-Aditivos para Concreto / Activación Mecano-Química

Dilemas y Expectativas

Referencias: www.concretovirtual.com/nanotecnologia

Nanotecnología en Concretos

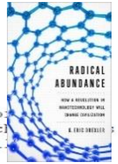


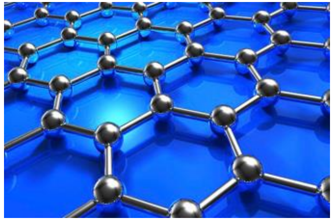
"A mi modo de ver, los principios de la Física no se pronuncian en contra de la posibilidad de maniobrar las cosas átomo por átomo".

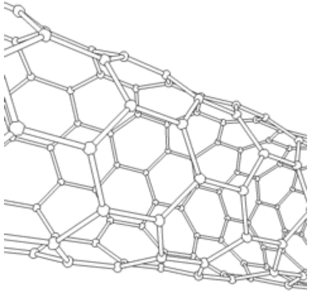
Engines Of Creation
The Coming Era of Nanotechnology

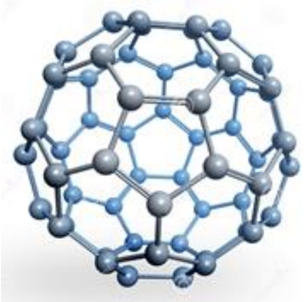
FOREWORD
by Marvin Minsky

K. Eric Drexler's *Engines of Creation* ...
original book about the consequences ...
It is ambitious and imaginative and, ...
thinking is technically sound.



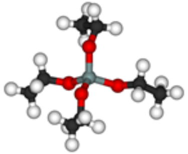






Abbreviations

C–S–H	calcium-silicate-hydrates
CH	calcium hydroxide (portlandite)
β-C_2S	β-dicalcium silicate
ITZ	interfacial transition zone
OPC	ordinary Portland cement
HSC	high strength concrete
SFRC	steel-fibre reinforced concrete
SCM	supplementary cementitious material
SF	silica fume
GGBS	ground granulated blast-furnace slag
FA	fly ash
NS	nanosilica
NA	nanoalumina
NC	nanoclay
NMK	nanometakaolin
NT	nanotitania
CNT	carbon nanotube
MWCNT	multi-walled carbon nanotube
CF	carbon fiber
CNF	carbon nanofiber
GO	graphene oxide
GSNS	graphene sulphonate nanosheet
MIP	mercury intrusion porosimetry
XRD	X-ray diffraction
DSC	differential scanning calorimetry
SEM	scanning electron microscopy

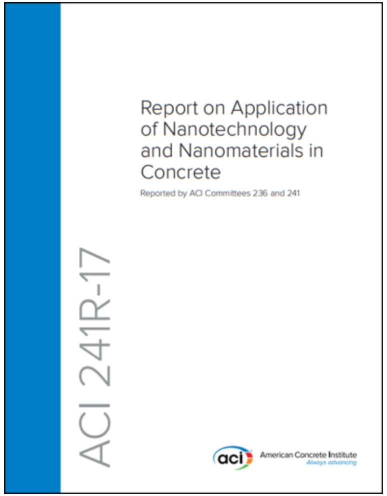


Fundamentos de Nanotecnología: ACI 241R-17 / K. Sobolev

Este informe proporciona **información** para aquellos involucrados en el **diseño de concreto y construcción** para que estén familiarizados con los factores involucrados en el **uso efectivo de nanomateriales y nanotecnología**.

Este documento **no** pretende ser un documento de **referencia** fuente para los **investigadores**.

Por el contrario, está dirigido a ingenieros y arquitectos que desean obtener una mayor comprensión de los efectos de los **nanomateriales y nano.aditivos** que se usan o se proponen para su aplicación en concreto.



ACI 241R-17

Report on Application of Nanotechnology and Nanomaterials in Concrete

Reported by ACI Committees 236 and 241

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Fundamentos: ACI 241R-17 / K. Sobolev

Hay dos enfoques principales en nanotecnología:

1) el **enfoque descendente** (de arriba hacia abajo), en el cual estructuras más grandes se reducen en tamaño a la escala nanométrica, manteniendo sus propiedades originales sin control a nivel atómico, o deconstruido de estructuras más grandes en partes compuestas más pequeñas. (parte superior de la figura 1.1a); y

2) el **enfoque ascendente**, también llamado nanotecnología molecular o fabricación molecular, presentado por Drexler et al. (1991), en que los materiales son diseñado a partir de átomos, o componentes moleculares, mediante un proceso de ensamblaje o autoensamblaje (parte inferior de la Fig. 1.1a).

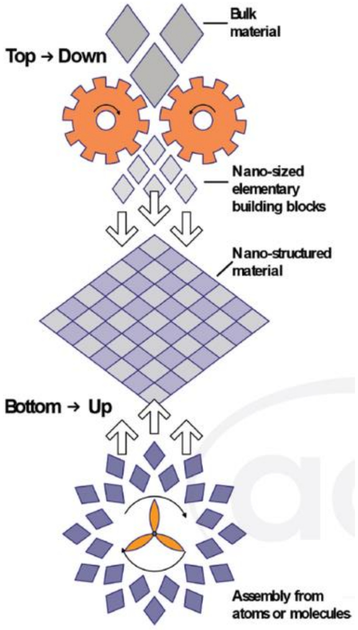


Fig. 1.1a—Illustration of the top-down and bottom-up approaches in nanotechnology (Sobolev and Ferrada-Gutiérrez 2005a).

CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Nanotechnology is a multidisciplinary field of science and engineering focused on understanding and controlling matter at dimensions between 1 and 100 nanometers, where unique phenomena enable novel applications.

Nanotechnology was first introduced by Feynman (1960) and is rapidly becoming an interdisciplinary field; many developments have emerged in physics, chemistry, biology, and engineering in the study of various materials or substances at the nanoscale.

There are two main approaches in nanotechnology: 1) the top-down approach, in which larger structures are reduced in size to the nanoscale while maintaining their original properties without atomic-level control (for example, miniaturization in the domain of electronics), or deconstructed from larger structures into smaller, composite parts (top part of Fig. 1.1a); and 2) the bottom-up approach, also called molecular nanotechnology or molecular manufacturing, introduced by Drexler et al. (1991), in which materials are engineered from atoms, or molecular components, through a process of assembly or self-assembly (bottom part of Fig. 1.1a). While most contemporary technologies, including concrete, rely on the top-down approach, molecular nanotechnology holds great promise for advancement in materials and manufacturing, electronics, medicine and healthcare, energy, biotechnology, information technology, and national security.

Nanoscience and nanoengineering are commonly-used terms that describe nanotechnology applications in concrete (Sobolev and Ferrada-Gutiérrez 2005a; Scrivener and Kirkpatrick 2008; Scrivener 2009; Raki et al. 2009; Garboczi 2009). To date, nanotechnology applications and advances in the fields of construction and building materials have been inconsistent (Bartos 2009; Sanchez and Sobolev 2010; Sobolev and Sanchez 2012). Implementing nanotechnology into concrete on a commercial scale remains limited. Some research developments, however, have been successfully converted into marketable products. The main advances have been in nanoscience of cementitious and pozzolanic materials, providing an increase in the knowledge and understanding of basic phenomena in cement at the nanoscale (Scrivener and Kirkpatrick 2008; Scrivener 2009). Examples include structure and mechanical properties of the main hydrate phases, origins of cement cohesion, cement hydration, interfaces in concrete, and mechanisms of degradation. Recent innovations in instrumentation for observing and measuring at the nanoscale are providing a wealth of new and unprecedented information about concrete. This information is crucial for a better understanding of mechanisms and factors influencing performance requirements, as well as predicting the service life of concrete and providing new insights for improvement. Important summaries and compilations of nanotechnology in construction can be found in Sobolev and Ferrada-Gutiérrez (2005a), Bartos et al. (2006), de Miguel et al. (2006), Scrivener and Kirkpatrick (2008), Sobolev and Shah (2008), Sobolev et al. (2008b), Sanchez

1.2—Scope

This report provides information for those involved in concrete design and construction so they are familiar with the factors involved in the effective use of nanomaterials and nanotechnology. This document is not intended as a primary reference source for researchers. Rather, it is aimed at engineers and architects who wish to gain further understanding of the effects of nanomaterials and nanoadditives being used or proposed for application in concrete.

Application of available technology is demonstrated for a range of nanoconcrete structures to show that technological risks are at a known and acceptable level and high industry standards maintained. An overview reports on the main developments in the fields of nanotechnology and nanoscience that are related to concrete, along with their implications and key findings. Factors affecting performance of fresh and hardened concrete are discussed to enable those involved in the evaluation and formulation of concrete mixtures to determine the effects of these factors.

The potential of nanotechnology to improve concrete performance can lead to the development of novel, sustainable, advanced cement-based composites with unique mechanical, thermal, and electrical properties. New developments have already taken place in nanoengineering and nanomodification of concrete. Current challenges, including proper dispersion, compatibility of the nanomaterials in cement, processing, manufacturing, safety, handling issues, and cost all need to be solved before the complete potential of nanotechnology can be realized in concrete applications. Additionally, introduction of these novel materials into the construction practice requires an evaluation and understanding of their potential impact on the environment and human health.

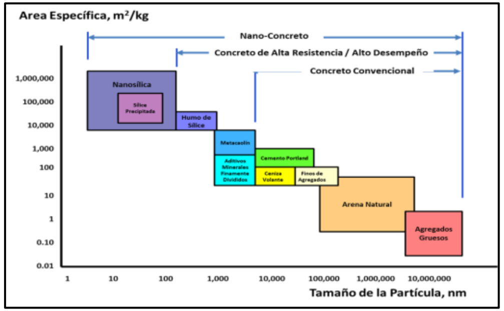
Fundamentos de Nanotecnología: K. Sobolev

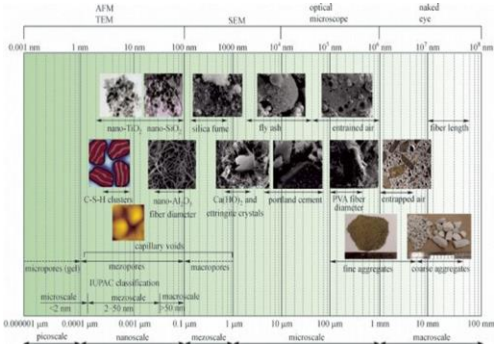
THE USE OF NANOPARTICLE ADMIXTURES TO IMPROVE THE PERFORMANCE OF CONCRETE

Konstantin Sobolev[1] Florence Sanchez[2] and Ismael Flores[3]

Abstract

Concrete can be nano-engineered by incorporating nano-sized building blocks or objects (e.g., nanoparticles and nanotubes) to control material behavior and add novel properties, or by grafting molecules onto cement particles, cement phases, aggregates, and additives (including nano-sized additives) to provide surface functionality, which can be adjusted to promote specific interfacial interactions. The nanoparticle is the elementary building block in nanotechnology and is comprised of up to thousands of atoms combined into a cluster of 1-100 nm. A reduction in size provides an exceptional surface area-to-volume ratio and changes in the surface energy, surface chemistry, and surface morphology of the particle, altering its basic properties and reactivity [1, 2, 5, 6].





Nanotecnología de Materiales

- Fundamentos de Nanotecnología: ACI 241R-17 / K. Sobolev / R. Feynman
- **Opciones actuales: Materiales Cementicios / Nanopartículas (Aditivos para Concreto)**
- Complementariamente: Nano-Aditivos para Concreto / Activación Mecano-Química

Dilemas y Expectativas

Referencias: **www.concretovirtual.com/nanotecnologia**

Opciones actuales: Materiales Cementicios / Nanopartículas

▪ DESEMPEÑO DEL CONCRETO CON NANOPARTÍCULAS

Se ha demostrado que Nanosilica (**nanopartículas de dióxido de silicio**, nano-SiO2) mejora la trabajabilidad y la resistencia en alto rendimiento y autocompactación del concreto. La mejora en el desempeño del concreto se ha atribuido a varios efectos de las nanopartículas. Las nanopartículas bien dispersas pueden actuar como centros de cristalización de los hidratos de cemento, acelerando así las reacciones de hidratación y actuando como relleno de los huecos entre los granos de cemento, reduciendo así la porosidad del material. También se ha demostrado que las nanopartículas bien dispersadas promueven la formación de cristales de menor tamaño (Como son $Ca(OH)_2$ y AFm), densificando así la microestructura y promoviendo la detención de grietas y mejorando las propiedades mecánicas del material.

▪ ADAPTACIÓN DE NANOPARTÍCULAS PARA UN DESEMPEÑO ÓPTIMO

Si bien pequeñas cantidades de nanopartículas (menos del 1% en peso de cemento) son generalmente suficientes para mejorar el rendimiento de los materiales compuestos, la aplicación práctica en concreto requiere la fabricación de una cantidad considerable de estas partículas. Por lo tanto, es primordial poder producir nanopartículas en grandes cantidades a bajo costo. Varias tecnologías se han utilizado para la producción de nanopartículas.

▪ DESARROLLO DE NUEVAS FUNCIONALIDADES

El **TiO2 fotocatalítico** se ha utilizado en concreto a base de cemento blanco, proporcionando al material capacidades de autolimpieza y purificación de aire. Es importante que el concreto arquitectónico mantenga sus características estéticas y decorativas, como el color, durante toda su vida útil, incluso en entornos urbanos altamente contaminados. Los materiales fotocatalíticos proporcionan una solución inteligente para minimizar eficazmente la acumulación de contaminantes en la superficie del concreto arquitectónico a través de la oxidación fotocatalítica.

THE USE OF NANOPARTICLE ADMIXTURES TO IMPROVE THE PERFORMANCE OF CONCRETE

Konstantin Sobolev[1] Florence Sanchez[2] and Ismael Flores[3]

Opciones actuales: Materiales Cementicios / Nanopartículas

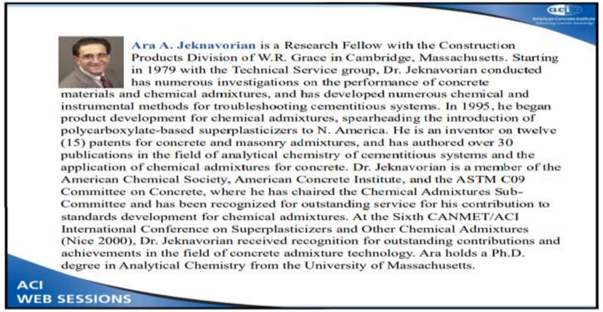
Future Developments

Vast progress in concrete science is expected in coming years by the adaptation of new knowledge generated from the rapidly growing field of nanotechnology. Development of the following concrete-related nanomaterials is on the way or can be anticipated:

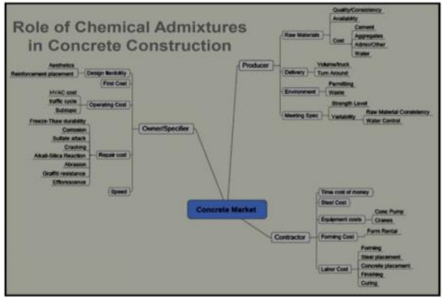
- Catalysts for the low-temperature synthesis of clinker and accelerated hydration of conventional cements;
- Grinding aids for superfine grinding and **mechano-chemical activation of cements and SCM**;
- **Binders reinforced with nano-particles**, nano-rods, nano-tubes (including single walled nanotubes, SWNTs), nano-dampers, nano-nets, graphenes, or nano-springs;
- Binders with enhanced/nanoengineered internal bond between the hydration products;
- Binders modified by nano-sized polymer particles and their emulsions, or polymeric nano-films;
- Bio-materials (including those imitating the structure and behavior of mollusk shells);
- Cement-based composites reinforced with new fibers containing nanotubes, as well as **fibers covered with nano-layers** (e.g., to enhance the bond, corrosion resistance, or introduce new properties such as electrical conductivity);
- **Next-generation nano-superplasticizers for "total workability control" and supreme water reduction**;
- Cement-based materials with supreme strength, ductility, and toughness;
- Binders with controlled internal moisture supply to **avoid/reduce micro-cracking**;
- **Cement-based materials** with **engineered nano-** and micro- **structures exhibiting supreme durability**;
- **Eco-binders modified by nanoparticles** and produced with substantially **reduced volumes of portland cement component** (down to 10-15%);
- Eco-binders with nanoparticles based on the alternative systems (MgO, phosphate, geopolymers, gypsum);
- Self-healing materials and **repair technologies using nano-tubes and nano-chemical admixtures**;
- **Materials with self-cleaning/air-purifying features based on photocatalyst technology**;
- **Materials with controlled electrical conductivit**y, **deformative** properties, non-shrinking **and low thermal expansion**;
- **Smart materials**, such as temperature-, moisture-, stress-sensing or responding materials.

Mechano-chemistry and nano-catalysts could change the face of modern cement industry by significantly reducing clinkering temperature and even realizing the possibility of cold-sintering clinker minerals in mechano-chemical reactors.

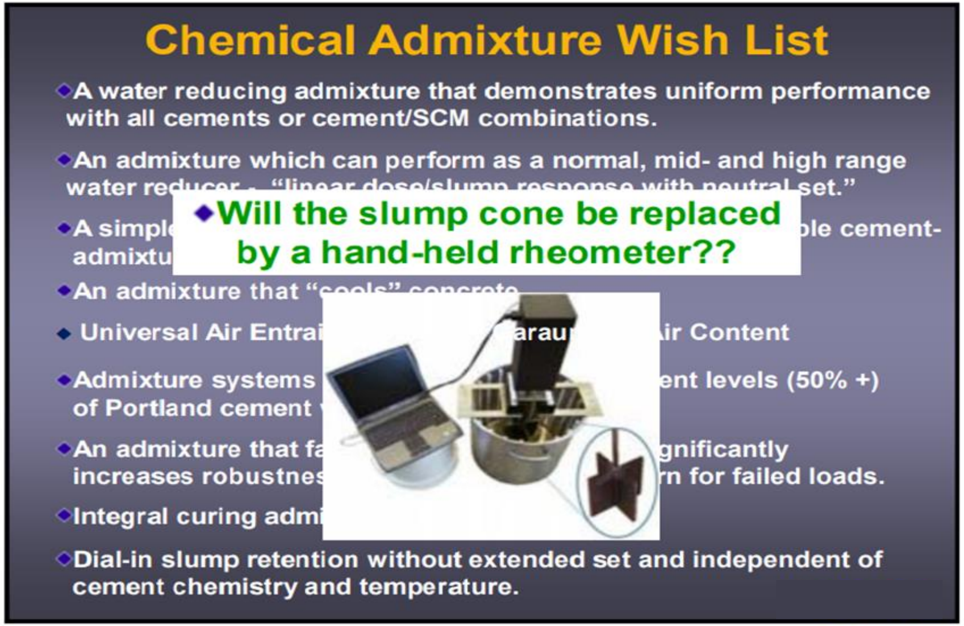
Opciones actuales: Aditivos para Concreto

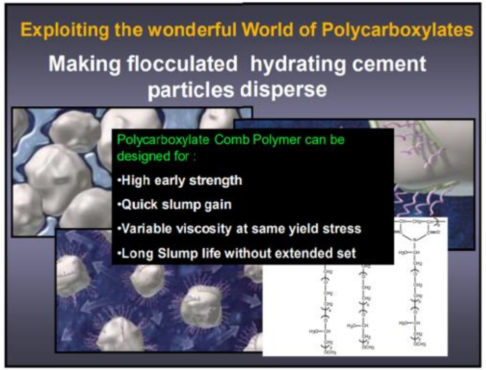


Ara A. Jeknavorian is a Research Fellow with the Construction Products Division of W.R. Grace in Cambridge, Massachusetts. Starting in 1979 with the Technical Service group, Dr. Jeknavorian conducted has numerous investigations on the performance of concrete materials and chemical admixtures, and has developed numerous chemical and instrumental methods for troubleshooting cementitious systems. In 1995, he began product development for chemical admixtures, spearheading the introduction of polycarboxylate-based superplasticizers to N. America. He is an inventor on twelve (15) patents for concrete and masonry admixtures, and has authored over 30 publications in the field of analytical chemistry of cementitious systems and the application of chemical admixtures for concrete. Dr. Jeknavorian is a member of the American Chemical Society, American Concrete Institute, and the ASTM C09 Committee on Concrete, where he has chaired the Chemical Admixtures Sub-Committee and has been recognized for outstanding service for his contribution to standards development for chemical admixtures. At the Sixth CANMET/ACI International Conference on Superplasticizers and Other Chemical Admixtures (Nice 2000), Dr. Jeknavorian received recognition for outstanding contributions and achievements in the field of concrete admixture technology. Ara holds a Ph.D. degree in Analytical Chemistry from the University of Massachusetts.

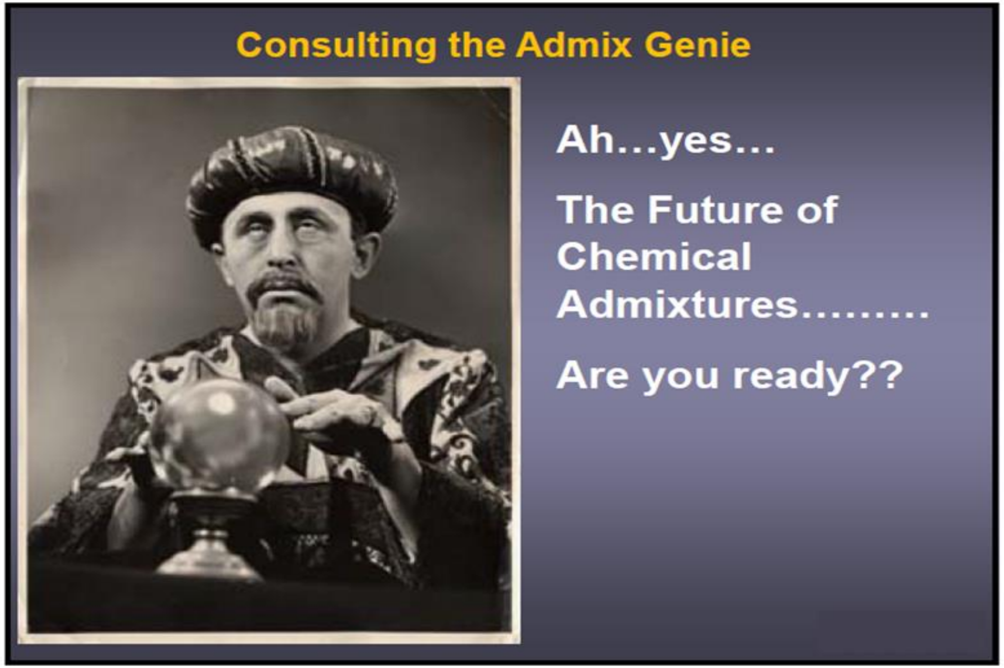


Opciones actuales: Aditivos para Concreto

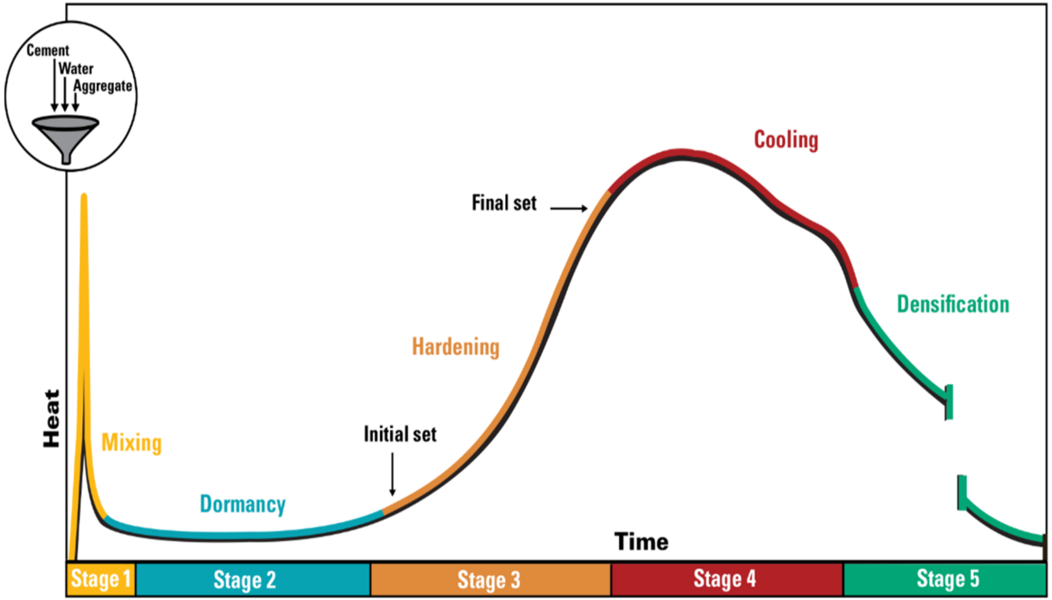




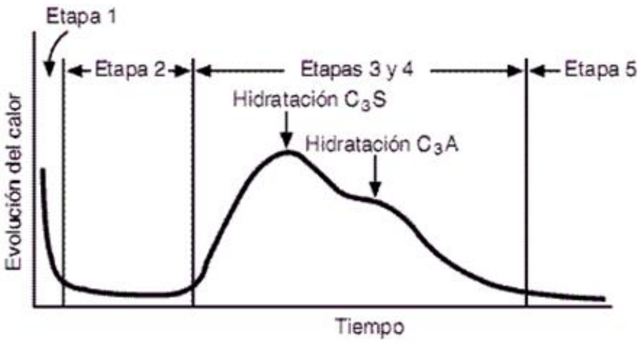
Opciones actuales: Aditivos para Concreto

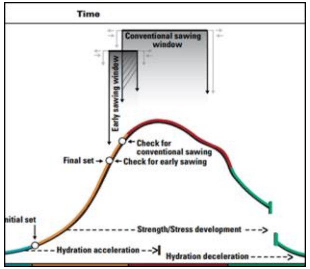


Opciones actuales: Aditivos para Concreto

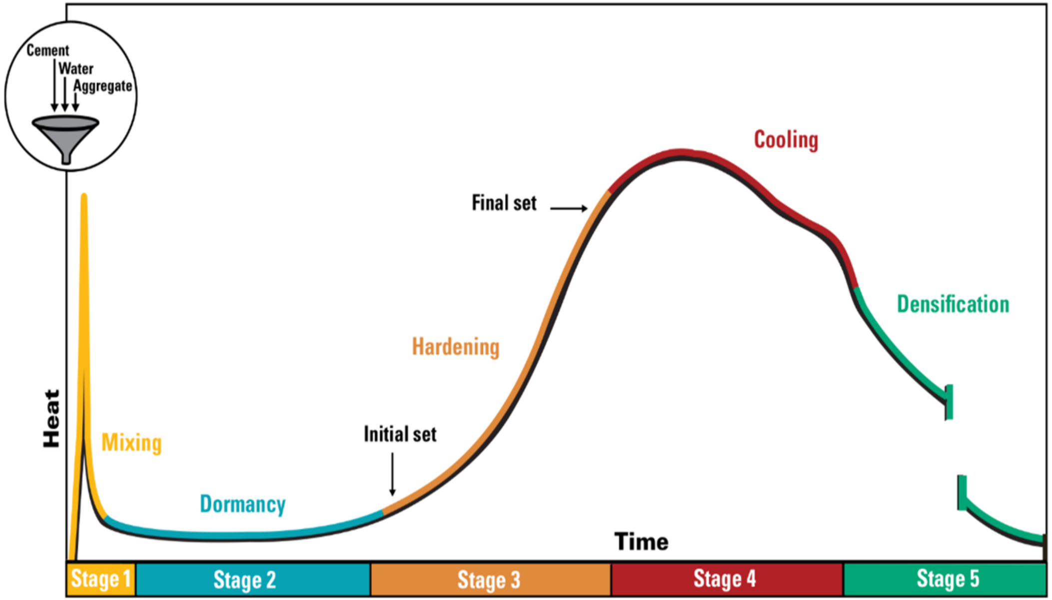


. General hydration curve delineating the five stages

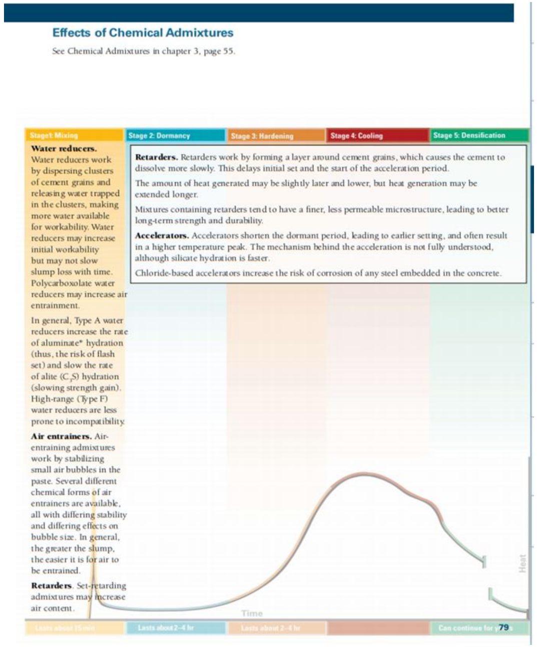




Opciones actuales: Aditivos para Concreto



. General hydration curve delineating the five stages



Effects of Chemical Admixtures

See Chemical Admixtures in chapter 3, page 55.

Stage 1: Mixing	Stage 2: Dormancy	Stage 3: Hardening	Stage 4: Cooling	Stage 5: Densification

Water reducers. Water reducers work by dispersing clusters of cement grains and releasing water trapped in the clusters, making more water available for workability. Water reducers may increase initial workability but may not slow slump loss with time. Polycarboxolate water reducers may increase air entrainment.

In general, Type A water reducers increase the rate of aluminate* hydration (thus, the risk of flash set) and slow the rate of alite (C_3S) hydration (slowing strength gain). High-range (Type F) water reducers are less prone to incompatibility.

Air entrainers. Air-entraining admixtures work by stabilizing small air bubbles in the paste. Several different chemical forms of air entrainers are available, all with differing stability and differing effects on bubble size. In general, the greater the slump, the easier it is for air to be entrained.

Retarders. Set-retarding admixtures may increase air content.

Retarders. Retarders work by forming a layer around cement grains, which causes the cement to dissolve more slowly. This delays initial set and the start of the acceleration period.

The amount of heat generated may be slightly later and lower, but heat generation may be extended longer.

Mixtures containing retarders tend to have a finer, less permeable microstructure, leading to better long-term strength and durability.

Accelerators. Accelerators shorten the dormant period, leading to earlier setting, and often result in a higher temperature peak. The mechanism behind the acceleration is not fully understood, although silicate hydration is faster.

Chloride-based accelerators increase the risk of corrosion of any steel embedded in the concrete.

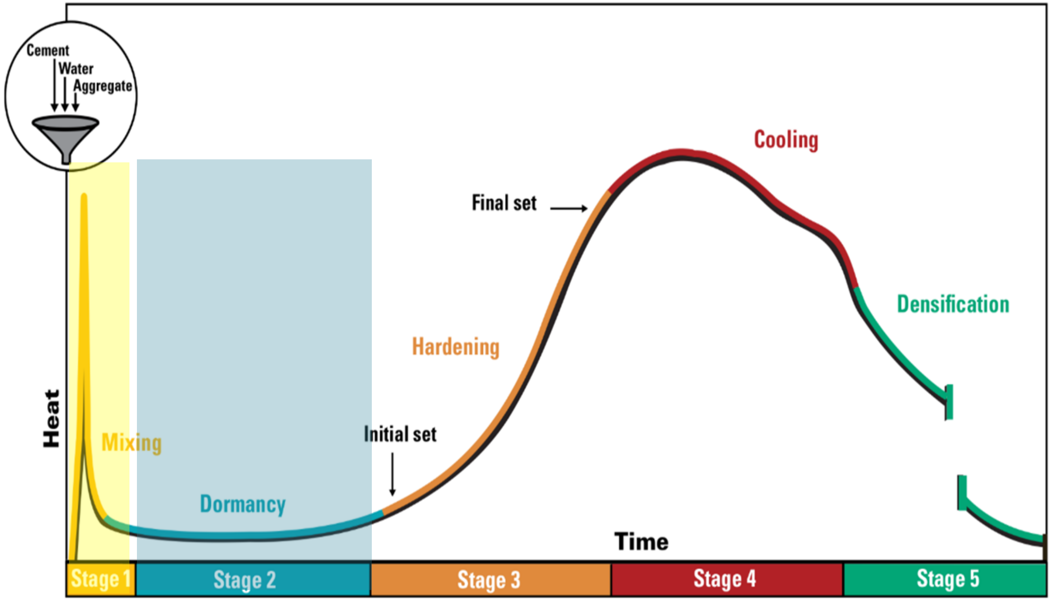
Nanotecnología de Materiales

- Fundamentos de Nanotecnología: ACI 241R-17 / K. Sobolev / R. Feynman
- Opciones actuales: Materiales Cementicios / Nanopartículas (Aditivos para Concreto)
- **Complementariamente: Nano-Aditivos para Concreto / Activación Mecano-Química**

Dilemas y Expectativas

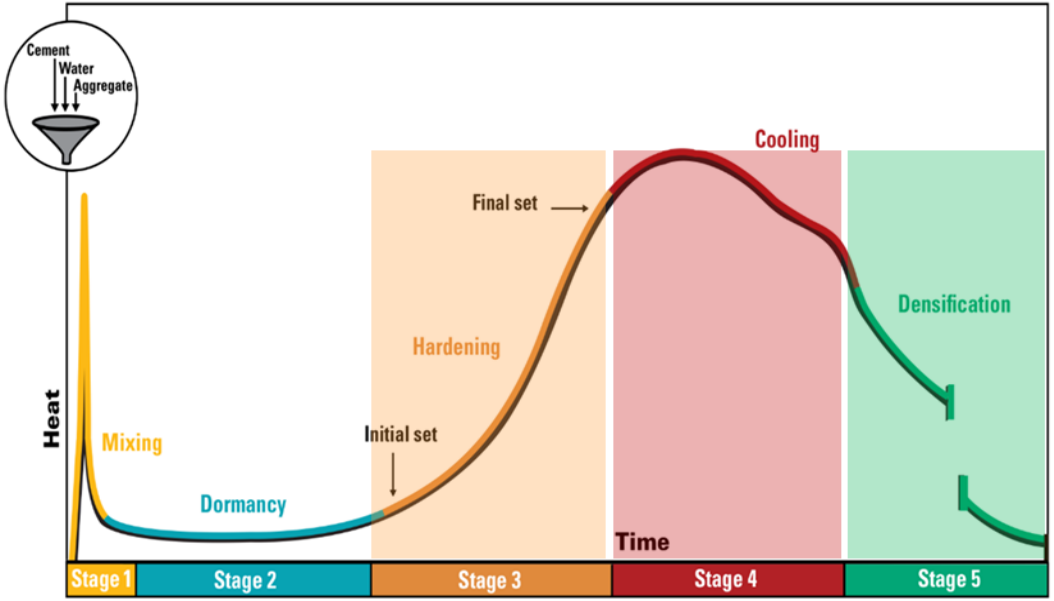
Referencias: **www.concretovirtual.com/nanotecnologia**

Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química



. General hydration curve delineating the five stages

Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química



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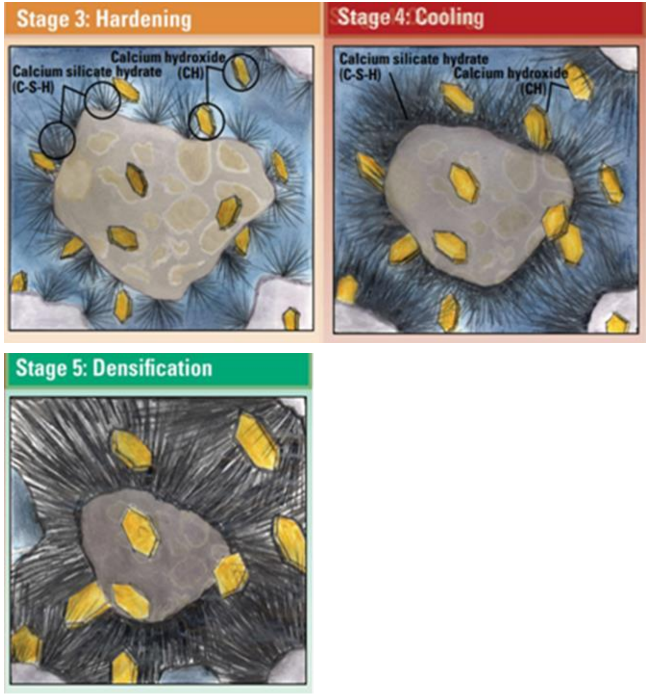
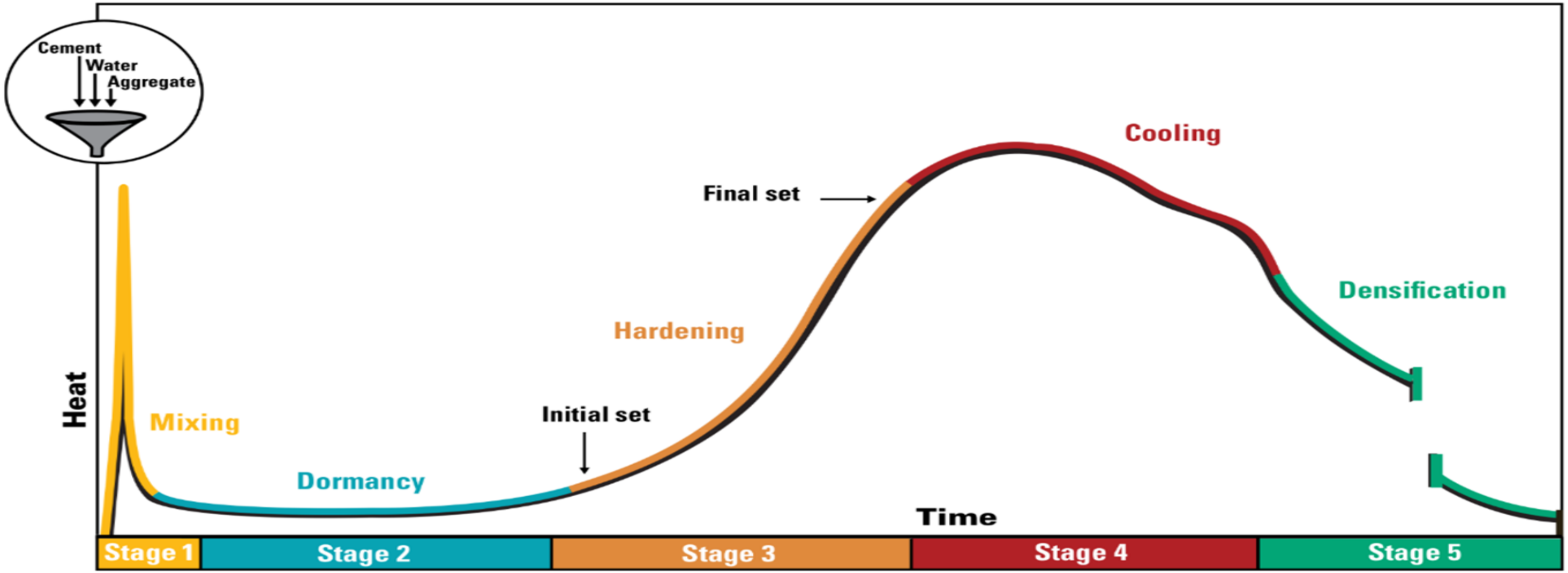


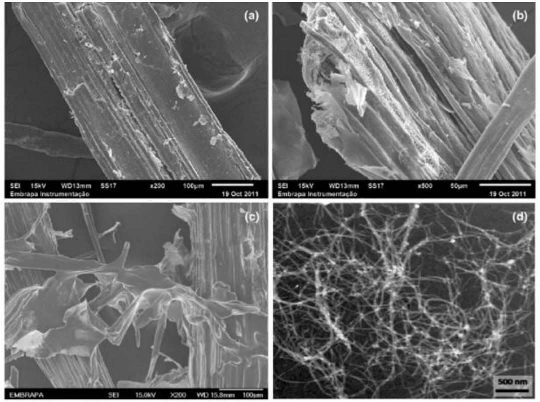
Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química



. General hydration curve delineating the five stages

Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química

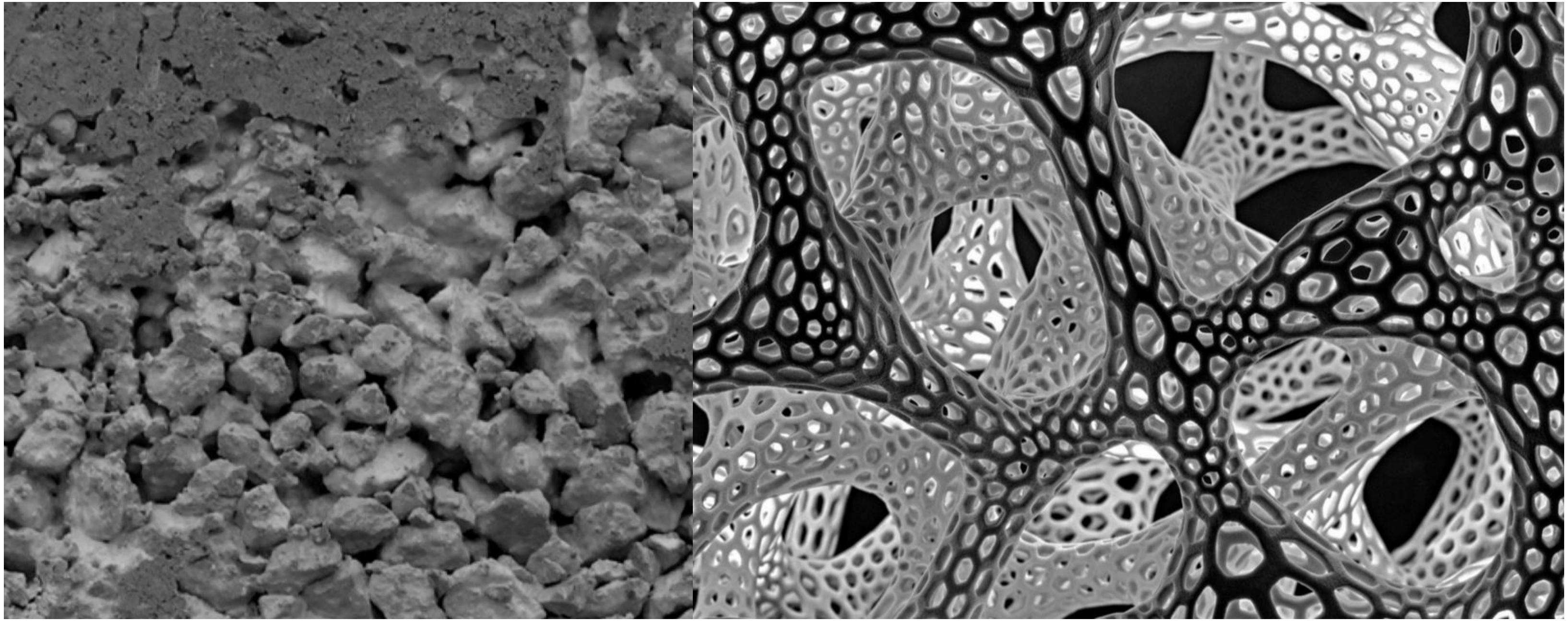
Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química



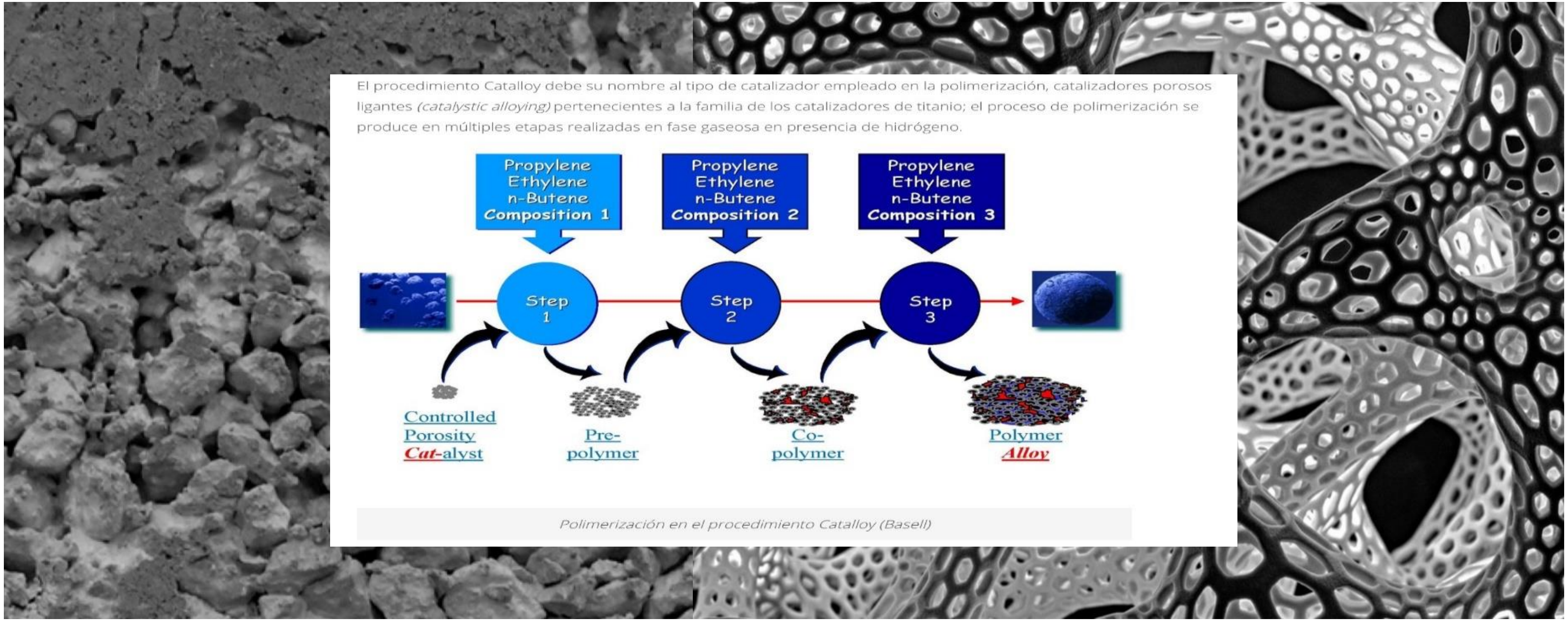
On Friday August 10, Product Manager Chris Eagon will be presenting at the Florida Prestressed Concrete Association Summer Convention on "A New Generation of Nanotechnology Admixtures for Concrete." Learn more: http://bit.ly/2vOIFA4

Ver traducción

Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química



Opciones actuales: Nano-Aditivos para Concreto / Activación Mecano-Química



El procedimiento Catalloy debe su nombre al tipo de catalizador empleado en la polimerización, catalizadores porosos ligantes *(catalystic alloying)* pertenecientes a la familia de los catalizadores de titanio; el proceso de polimerización se produce en múltiples etapas realizadas en fase gaseosa en presencia de hidrógeno.

Polimerización en el procedimiento Catalloy (Basell)

Nanotecnología de Materiales

- Fundamentos de Nanotecnología: ACI 241R-17 / K. Sobolev / R. Feynman
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Dilemas y Expectativas

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Dilemas y Expectativas

Dilemas y Expectativas

INNOVACIÓN SOSTENIBLE

Zanahorias y remolachas para construir edificios más fuertes y ecológicos

0

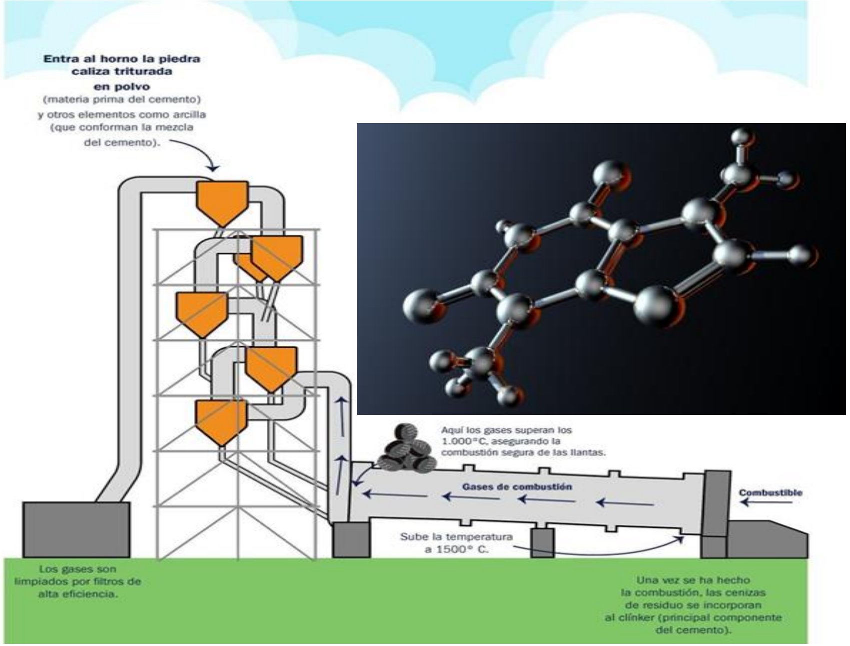
• Estas hortalizas permiten aumentar el rendimiento del hormigón, además de detener la formación de grietas, evitar la corrosión y hace que los materiales sean más duraderos

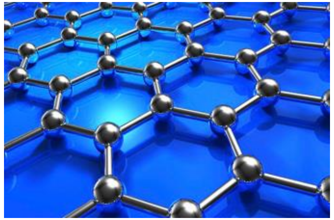
NEUS PALOU
30/07/2018 12:45

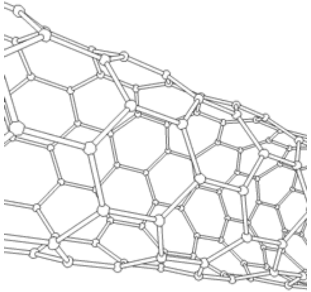
Actualizado a
30/07/2018 13:00

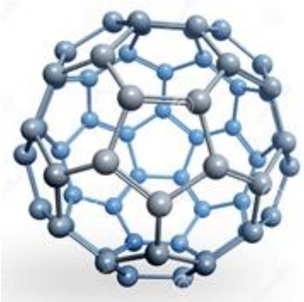
Temas relacionados

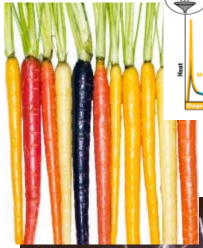
Dilemas y Expectativas

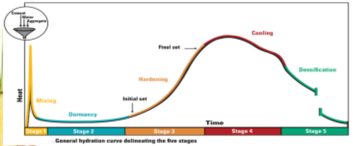


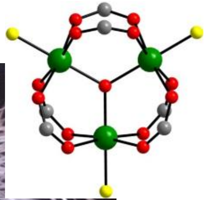


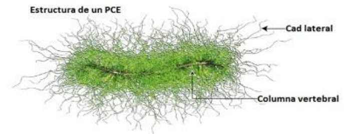






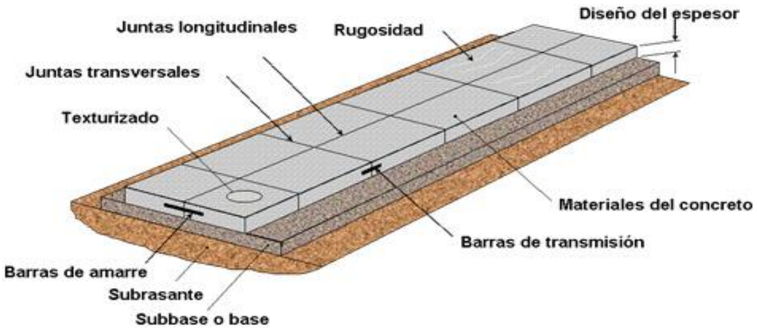


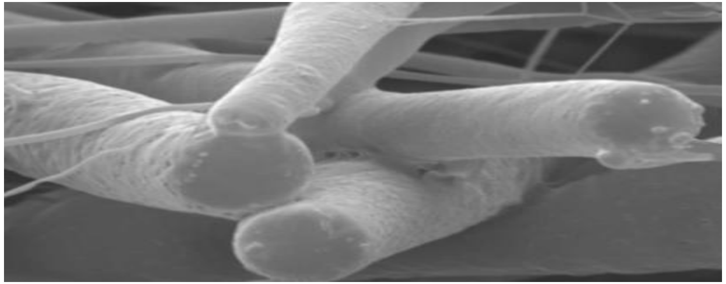




محمد

Dilemas y Expectativas





1. Nanotecnología en Concretos
   - Nanotecnología de Materiales
     - Materiales Cementicios / Nanopartículas
     - Nano-Aditivos para Concreto
   - Dilemas y Expectativas

2. **Proyectos Constructivos en Asia**
   - Consideraciones Técnicas
     - Ensayes en Obras / Normativas
   - Consideraciones Industriales
     - Manufactura / Transportación / Colocación

3. Preguntas y Respuestas

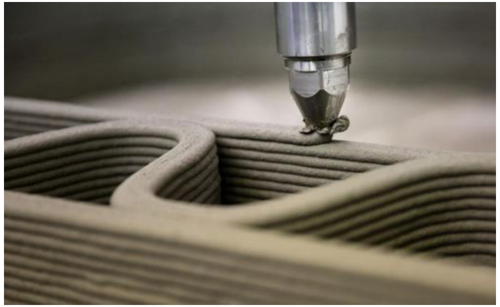
Proyectos Constructivos en Asia

- Consideraciones Técnicas
- Consideraciones Industriales

Referencias: www.concretovirtual.com/nanotecnologia

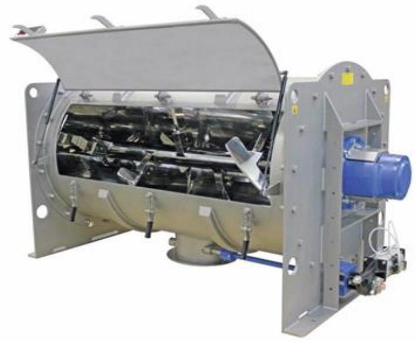
Preguntas y Respuestas

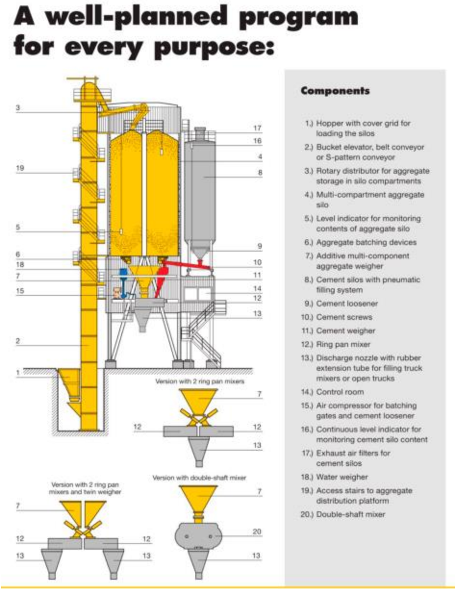
Consideraciones Técnicas
Requerimientos Normativos / Ensayes en Obras



Consideraciones Industriales
Equipos de Manufactura / Transportación / Colocación

Consideraciones Industriales
Equipos de Manufactura / Transportación / Colocación





Consideraciones Industriales
Equipos de Manufactura / Transportación / Colocación




Proyectos Constructivos en Asia

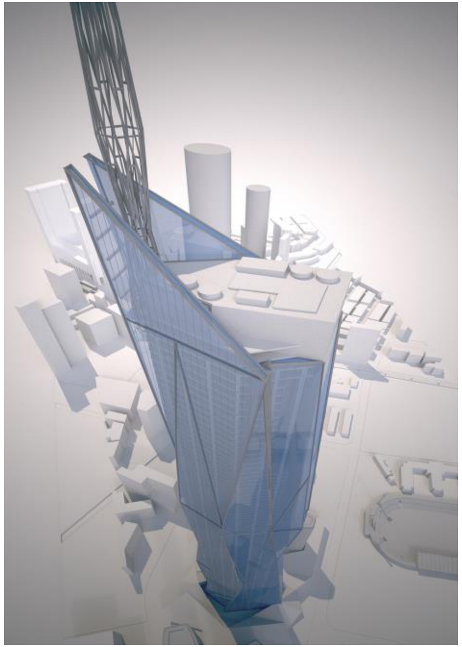
- Consideraciones Técnicas
- Consideraciones Industriales

Referencias: www.concretovirtual.com/nanotecnologia

Preguntas y Respuestas

KL 118

Malasia: KL 118 (Permodalan Nasional Berhad - PNB118)



1. Burj Khalifa, United Arab Emirates - 2,717 Feet
Dubai's Burj Khalifa is the tallest building in the world.

2. Shanghai Tower, China - 2,073 Feet
The Shanghai Tower is the world's second tallest building as well as the tallest building in China, with 121 floors.

3. Makkah Royal Clock Tower, Saudi Arabia - 1,972 Feet
The Makkah Royal Clock Tower in Saudi Arabia is the third tallest building in the world. It stands at a total of 601 meters. The government-owned complex features a hotel with 120 floors, as well as a conference center, an Islamic museum, and a prayer room with a capacity of 10,000 people

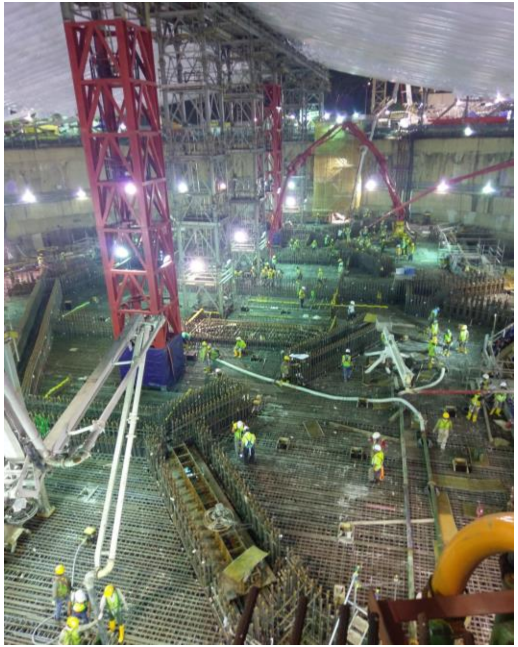
?. PNB 118 (KL 118), Malaysia - 2,113 Feet

The Merdeka 118 development is funded by Permodalan Nasional Berhad (PNB). When completed in 2024, the tower will be the tallest building in Malaysia .

PNB 118 is a 118-storey, 644-metre (2,113-foot) megatall skyscraper currently under construction in Kuala Lumpur, Malaysia.

Proyectos Constructivos en Asia: Malasia (KL118 / PNB118)

Malasia: KL 118 (Permodalan Nasional Berhad - PNB118)



Proyectos Constructivos en Asia: Malasia (KL118 / PNB118)

Malasia: KL 118 (Permodalan Nasional Berhad - PNB118)

Tuas Megaport

Proyectos Constructivos en Asia: Singapur (Tuas Megaport)

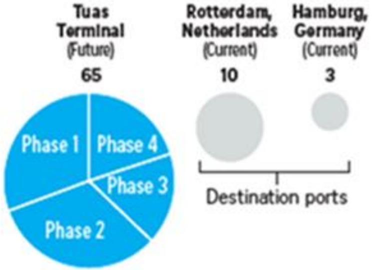
Singapur: Tuas Megaport

COMPARISON OF AUTOMATED TERMINAL OPERATIONS

Tuas Terminal

- Trans-shipment port that is many times larger than the ones in Europe.
- More complex to automate a trans-shipment container terminal of this scale than a destination port.

Capacity (million TEUs):



The port will occupy 1,339ha of land – about the size of
two Ang Mo Kio New Towns

Amount of land to be reclaimed
1,085ha

First set of berths ready by
2021

TUAS TERMINAL FACTS AND FIGURES

Phase	Area (ha)	Start of operations	Cargo handling capacity (TEUs, million)*
1	414	Early 2020s	20
2	405	Late 2020s	21
3	260	Early 2030s	11
4	260	Mid-2030s	13

NOTE: *Twenty-foot equivalent units. Refers to a common international standardised 20-foot-long (6.1m) container type.

$1 billion
Approximate cost savings in reclamation fill material by re-using dredged and excavated materials from land construction projects such as rail infrastructure projects, for reclamation of Tuas Phase 1.

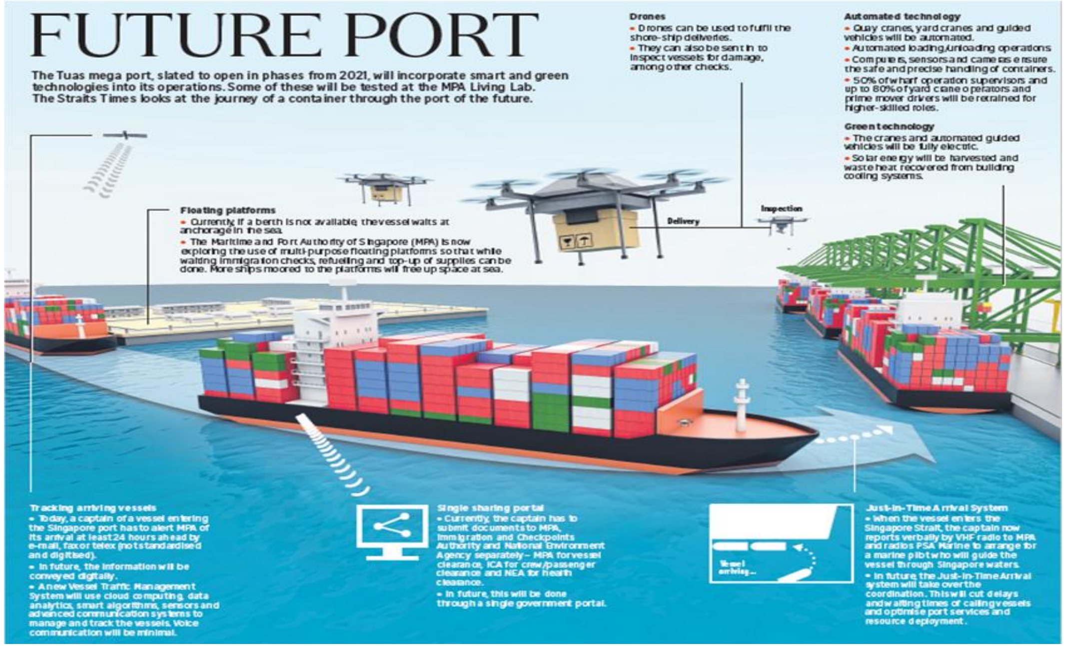
Feasibility studies are being done on the construction of an elevated area 42m above ground – overlooking port operations – to house warehousing, distribution and logistics operations, as well as possibly
cafes, retail stores and other amenities.

2,300 out of 2,800 coral colonies
around Sultan Shoal lighthouse – in the vicinity of the proposed reclamation works – have been relocated to the Southern Islands successfully.

$6 million
Cost of the coral relocation project

TEXT: KARAMJIT KAUR PHOTO: GOOGLE STRAITS TIMES GRAPHICS: CHNG CHOON HIONG, LIM YONG

Singapur: Tuas Megaport



Works are in full swing at the future Tuas port, with reclamation ongoing for two out of four phases of the development and more than 3km of caisson already installed to form the wharf.

The caisson, which sits on a foundation on the seabed, is a 28m-high concrete watertight structure - about the height of a 10-storey Housing Board block. Using caissons to build the wharf structure is faster than traditional methods like piling.

In all, 8.6km of caisson will have to be constructed under Phase 1 of the Tuas port project, which aims to grow the Singapore port, amid competition from other regional and global ports.

Proyectos Constructivos en Asia: Singapur (Tuas Megaport)

Singapur: Tuas Megaport

https://www.channelnewsasia.com/news/cnainsider/singapore-needs-tuas-mega-port-maritime-trade-automated-9934474

https://www.youtube.com/watch?v=Xu6zk8mT9-Q

https://www.youtube.com/watch?v=XTCvl1-Kz2Y

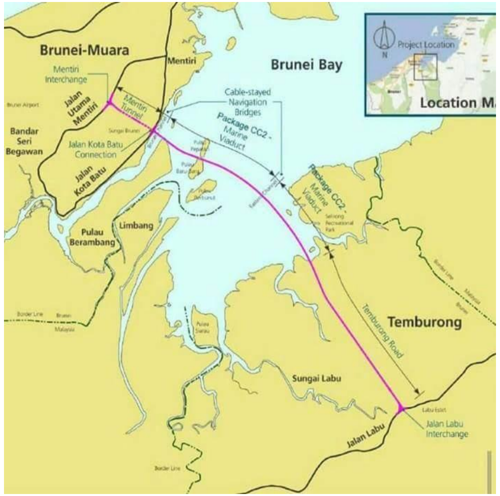
https://www.youtube.com/watch?v=HrZg96L8yaY

Temburong Bridge

Proyectos Constructivos en Asia: Brunei (Temburong Bridge)

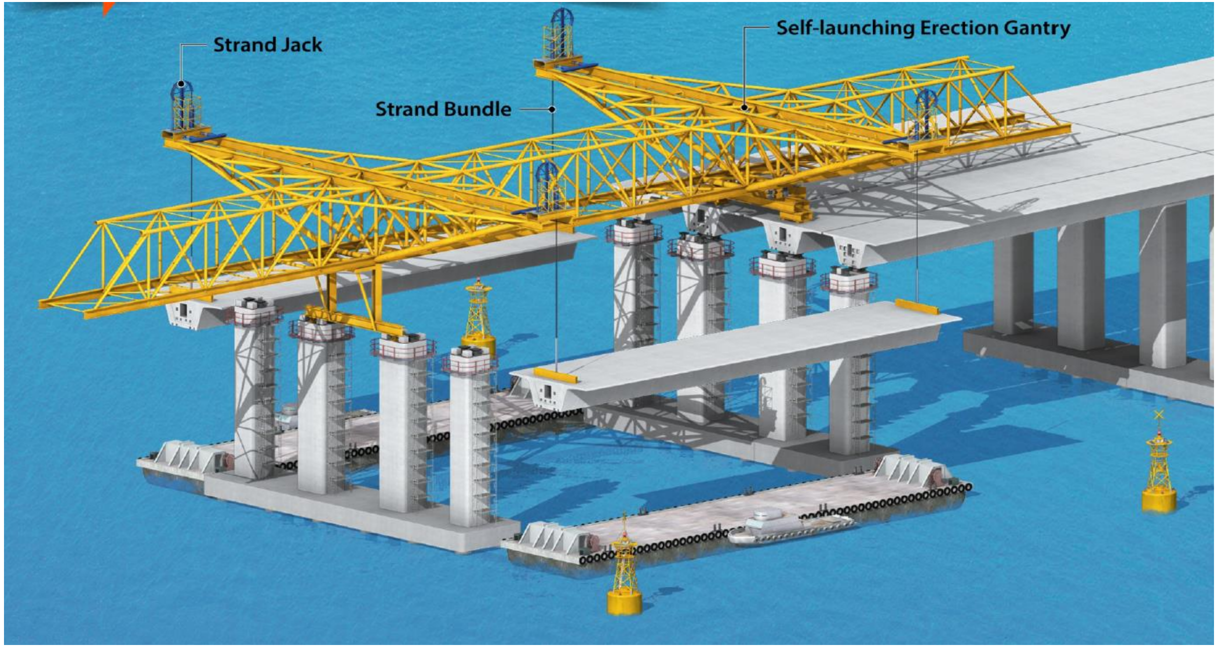
Brunei: Temburong Bridge

Brunei: Temburong Bridge



Proyectos Constructivos en Asia: Brunei (Temburong Bridge)

Brunei: Temburong Bridge



Prefabricación
Singapur / Myanmar

Singapur: Concreto Ligero Prefabricado

AN OFF-SITE REVOLUTION

MORE SMEs IN THE CONSTRUCTION SECTOR ARE ADOPTING NEW TECHNOLOGIES TO SAVE COSTS AND BOOST PRODUCTIVITY

AT A FACILITY in Malaysia, a room is being fitted with air-conditioning and lighting fixtures. Once done, the unit meant to house students from Nanyang Technological University (NTU) will be almost ready to be inhabited; except for the fact that it has to be transported wholesale to its eventual location at the university grounds in Singapore and hoisted into place.

NTU's new residential halls at North Hill will be Singapore's first high-rise buildings using a unique construction method that allows individual rooms to be stacked on top of each other. Whole rooms complete with internal finishes, fixtures and fittings are built from scratch in a factory, before being transported to a construction site for installation just like a Lego block.

Known as Prefabricated Pre-Finished Volumetric Construction (PPVC), this method saves up to 25-40 per cent in manpower and 15-20 per cent in construction time. It also reduces noise and dust pollution on-site as more activities are done off-site.

Comprising six 13-storey blocks, the new residential complex will be a one-stop integrated hub with eateries, shops and common spaces such as lounges and study rooms, all located within the first three floors. The North Hill halls will accommodate over 1,850 students, who will get to enjoy a host of facilities, including the university's largest fully-equipped gym which is about five times the size of a four-room HDB unit.

Ready in 2016, the project has already clinched the Green Mark Platinum – the highest award for sustainable building design in Singapore awarded by the Building Construction Authority (BCA).

NTU awarded the North Hill project to Singapore Piling & Civil Engineering. Construction started in July 2014. The project is set to be the first in Singapore to be completed using PPVC.

DRIVING PRODUCTIVITY GAINS

PPVC is just one of several emerging technologies that is changing the face of the built environment sector, and helping to boost the productivity of industry players.

BCA is pushing for greater adoption of such technologies as it seeks to wean the industry off its reliance on foreign workers. The Second Construction Productivity Roadmap that was unveiled earlier this year aims to drive the sector towards meeting the national productivity target of an average 2-3 per cent improvement annually from 2011 to 2020.

A big part of that push involves promoting labour-efficient construction methods such as PPVC, where as much work as possible is done off-site. PPVC can be used for a variety of developments, including residential, mixed-use and hotels, and contractors and service providers here are already starting to employ this exciting technology.

One SME that has adopted PPVC is mechanical and electrical (M&E) engineering services company Sing Moh Electrical Engineering. The firm is responsible for installing all the fittings in the units of the North Hill project at the off-site location.

Apart from the cost and productivity benefits, being able to do its work at the ground level also increases worker safety, says Sing Moh director Kenneth Teo. "If we didn't use PPVC, we might have to work as high as 12 or 13 floors up, where there is the risk of working at height. Now, the risk is reduced and there is no value you can put on that – it is priceless," he says.

The North Hill project is Sing Moh's first experience with PPVC, and required some changes in thinking initially. "Being something new, there was a learning curve for us. It required everyone to change their mindset. But once we overcame that, we recognised the benefits of working this way," remarks Mr Teo.

Sing Moh had earlier adopted other construction technologies such as Building Information Modelling (BIM), which can be used to model everything from graphics, drawings and reports to design analysis, schedules and facilities management. This helps to surface problems before actual work begins and allows building teams to make better-informed decisions as well as foster greater collaboration among team members.

Says Mr Teo: "Before it happens on-site, we can already visualise problems using the software and coordinate with other teams on how to correct it."

CHAMPIONING SUSTAINABLE CONSTRUCTION

NTU's North Hill residential complex will also leverage technology to build in sustainable features that take advantage of its natural surroundings. Using computer modelling of the sun and wind patterns on-site, the buildings' designers aim to harness natural winds so that students will enjoy good ventilation with average wind speeds of about 0.6 metre per second.

Meanwhile, to reduce the need for air-conditioning, all rooms in the residential halls will have windows that reflect heat using a special coating, and louvres that shield any direct sunlight.

All these sustainable features are in line with NTU's emphasis on sustainability and its ambition to achieve a 35 per cent reduction in energy, water and waste by 2020 under its EcoCampus initiative. ■

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Residential halls at North Hill	
Size	• Six blocks
Floors	• 13 storey public high rise buildings which includes three storeys of common facilities (ie common study areas, sky lounges, gym)
Expected completion date	• First quarter 2016
Capacity and features	• Over 1,850 students • Common study areas and lounges • Sky lounges • Approx 580 sq m gymnasium (largest gym in NTU's campus) • One multi-purpose hall • Reading rooms • Music/dance rooms • Rooftop barbecue terraces • F&B and shops
Eco features	• Around 480 solar-powered energy systems, which will power lighting for common areas and hot water dispensers. • Motion sensor LED system • Dual refuse system (for recycling) • "Low E" glazed windows – special coating that reflects heat and UV rays • Specially designed louvres for enhanced ventilation • "Green cement" (reused industrial by-products such as ash, silica and slag) used for foundation
Construction method	• "Lego-style" prefabricated pre-finished volumetric construction (PPVC)

Construction Productivity

GAME CHANGING TECHNOLOGY

IN Prefabricated Pre-finished Volumetric Construction (PPVC), entire flats or modules complete with internal finishes, fixtures and fittings are manufactured in factories, and then transported to site for installation in a Lego-like manner. PPVC can be considered for residential and mixed developments, institutional and other projects as well as other accommodation type of developments such as hotels, hostels and nursing homes.

BENEFITS OF PPVC:

- PPVC can significantly speed up construction. It can potentially achieve productivity improvement of up to 50 per cent in terms of manpower and time savings, depending on the complexity of the projects.
- Minimised dust and noise pollution as more activities are done off-site.
- Improved site safety with bulk of the installation activities and manpower moved off-site to a factory controlled environment.

PPVC IN SINGAPORE

Other PPVC projects in Singapore include OUE's extension of the Crowne Plaza Hotel at Changi Airport, which was awarded to Dragages Singapore in June 2014.

Dragages is working with Unitised Building, which is prefabricating the modules for the Crowne Plaza extension at its Shanghai factory before being shipped to Singapore for installation.

Meanwhile, City Development Limited (CDL) is the first developer in Asia to use PPVC to develop a large-scale residential development – an executive condominium (EC) at Canberra Drive.

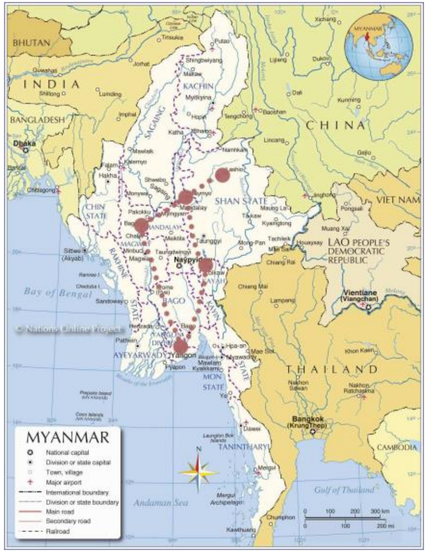
The EC comprises eight 10 to 12-storey blocks with 638 units constructed using some 5,000 building modules. This is likely the largest application of PPVC in a large-scale residential project in the world.

Since November 2014, selected projects under Government Land Sales (GLS) programme are required to adopt high-impact productive technologies. Three GLS sites at Yishun, Jurong West and West Coast Vale will use PPVC technology.

Singapur: Concreto Ligero Prefabricado

Proyectos Constructivos en Asia: Myanmar (Prefabricación HSC)

Myanmar: Durmientes Prefabricados



1. Nanotecnología en Concretos
   - Nanotecnología de Materiales
     - Materiales Cementicios / Nanopartículas (Aditivos para Concreto)
     - Nano-Aditivos para Concreto / Activación Mecano-Química
   - Dilemas y Expectativas

2. Proyectos Constructivos en Asia
   - Consideraciones Técnicas
     - Ensayes en Obras / Normativas
   - Consideraciones Industriales
     - Manufactura / Transportación / Colocación

3. **Preguntas y Respuestas**

Preguntas y Respuestas

рахмат
danke
謝謝
ngiyabonga
teşekkür ederim
spas
Баярлалаа
mersi
kia ora
barka
welalin
tack
mahalo
tapadh leat
спасибо
faafetai lava
vinaka
спасибі
blagodaram
dank je
misaotra
matondo
paldies
grazzi
kiitos
dankie
dhanyavad
nanni
nandri
thank you
gracias
хвала
asante
manana
obrigada
tenki
bedankt
hvala
maururu
köszönöm
bayarlalaa
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sagolun
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kop khun krap
obrigado
mesi
didi madloba
najis tuke
ありがとう
tanemirt
grazie
arigatô
takk
dakujem
trugarez
kam sah hamnida
rahmat
terima kasih
rahmet
ευχαριστώ
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dhanyavadagalu
shukriya
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merci

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