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es una publicación bimestral editada por la Alianza FiiDEM, AC. Registros y permisos en trámite.

Presentación

En la actualidad las nuevas tecnologías se desarrollan a velocidades vertiginosas. Como consecuencia, el mundo y en especial las empresas se encuentran sujetas a cambios constantes, por lo que se ven obligadas a modificar sus procesos y productos, desarrollando conocimientos y estrategias competitivas. Para mantener su cadena de valor, las organizaciones requieren mantenerse informadas sobre avances tecnológicos que pueden cambiar su entorno en el mediano y largo plazos. En otras palabras, disponer de la información oportuna y veraz que les permita tomar decisiones es un factor que ha ido adquiriendo gran importancia para mantener una posición competitiva a nivel global. Además, la disponibilidad de fuentes de información y las nuevas tecnologías de información y comunicación permiten conocer los avances tecnológicos de manera casi inmediata.

Este *Boletín de Inteligencia Tecnológica* tiene como objetivo publicar información sobre los resultados y experiencias que se obtienen en el mundo científico y empresarial que día a día aportan a los procesos de innovación. Además, constituye una vía de divulgación e intercambio de información entre empresas, centros de investigación, sociedades técnicas e instituciones gubernamentales. Su frecuencia será bimestral y se enfocará en temas de interés para el desarrollo de infraestructura en México.

La primera edición es producto del trabajo de los participantes en el *Programa de Aceleración del Conocimiento en Inteligencia Tecnológica* de la Unidad de Información e Inteligencia Tecnológica de la Alianza FiiDEM, AC, y se enfoca en tres temas: concreto y adiciones, corrosión producida por H_2S y CO_2 en ductos petroleros y sistemas de almacenamiento para redes inteligentes (*smart grid*).

Presenta una recopilación de artículos y patentes que fueron publicados o desarrollados en los meses de mayo y junio del presente año, así como los eventos a realizarse en los próximos meses en torno a dichos temas.

Para nosotros es muy importante contar con su retroalimentación respecto de esta primera edición, de manera que podamos integrar un producto a la medida de sus necesidades.

Unidad de Información e Inteligencia Tecnológica
Alianza FiiDEM, AC

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ARTÍCULOS

Esta sección recopila artículos de diversas fuentes, mismas que son identificadas en cada caso. Los documentos referidos pueden ser de acceso restringido. Si algún artículo es de su interés, favor de contactar a:
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Materiales
Durabilidad del Concreto

Corrosión del acero de refuerzo en concretos de diferentes resistencias a la compresión

Corrosion of steel bars embedded in concrete having compressive strengths of 20, 30 and 46 MPa was investigated. Reinforced concrete specimens were immersed in a 3% NaCl solution by weight for 1, 7 and 15 days. In order to accelerate the chemical reactions, an external current of 0.4 A was applied using portable power supply. Corrosion rate was measured by retrieving electrochemical information of polarization technique. Pull-out tests of reinforced concrete specimens were then conducted to assess the corroded steel/concrete bond characteristics.

Experimental results showed that corrosion rate of steel bars and bond strength between corroded steel/concrete were dependent on concrete strength and accelerated corrosion period. As concrete strength increased from 20 to 46 MPa, corrosion rate of embedded steel decreased. First day of corrosion acceleration caused a slight increase in steel/concrete bond strength, whereas sever corrosion after 7 and 15 days of corrosion acceleration significantly reduced steel/concrete bond strength. Visual and metallographic observation of steel bars removed from concrete samples after testing revealed that the severity of corrosion reactions and reduction of steel bar diameter increased as the corrosion acceleration period increased. Presence of localized corrosion pits as well as severe corrosion grooves of steel bars was confirmed after 7 and 15 days of corrosion acceleration, respectively.

Fuente: *Construction and Building Materials*, October 2011, volume 25, issue 10, pages 3915 – 3925, L. Abosrra, A.F. Ashour and M. Youseffi. School of Engineering, Design and Technology, University of Bradford, Bradford BD7 1DP, UK.

Leer completo en: http://www.sciencedirect.com/science/article/pii/S0950061811001632

Propiedades de los morteros de cal-metacaolín usados en la restauración de mamposterías históricas

Mortars were prepared by mixing metakaolin/hydrated lime (with a ratio of ≤1 by mass) with sand and were evaluated in order to be used as restoration mortars on historic masonries. During 12-months curing time the chemical reactions were evaluated by thermal analysis (DTA/TG), the microstructural properties by mercury intrusion porosimetry (MIP) and the mechanical characteristics (flexural and compressive strength, static modulus of elasticity) by conventional mechanical tests. As the metakaolin/lime ratio increased, the content of total bound water, the static modulus of elasticity, the compressive and flexural strength increased while the pore size distribution shifted to smaller values. All mixes presented sufficient mechanical and microstructural properties comparable to traditional structural materials.

Fuente: *Applied Clay Science,* vol. 53, issue 1, July 2011, pages 15-19. E. Aggelakopouloua, A. Bakolasa, and A. Moropouloua. National Technical University of Athens, School of Chemical Engineering, Department of Materials Science and Engineering, 9 Iroon Polytechniou St., 15780, Zografou, Athens, Greece.

Leer completo en: http://www.sciencedirect.com/science/article/pii/S0169131711001372

Efecto de los aditivos superplastificantes en la cinética de hidratación y en las propiedades mecánicas de las mezclas de cemento Pórtland

Hydration of ordinary Portland cement in the presence of two different types of superplasticizers namely sodium lignosulfonate (LS) and naphthalene sulfonate-formaldehyde condensate (NSF) was studied using different experimental techniques. Superplasticized ordinary Portland cement pastes were prepared using the values of standard water of consistency with different additions of each types of superplasticizers used. Pastes were hydrated for different time intervals under normal curing conditions. The results reveal that both of superplasticizers increase the workability and reduce the standard water of consistency. This results in an improvement in the mechanical properties of superplasticized cement pastes at all ages of the hydration–hardening process. Naphthalene sulfonate-formaldehyde condensate was found to has the higher efficiency in improving the mechanical properties of the hardened pastes than that of sodium lignosulfonate superplasticizer.

Fuente: *Journal of Advanced Research*, Article in press, 24 May 2011, Safaa M.A. El-Gamal, Fawzia M. Al-Nowaiser and Asmaa O. Al-Baity. Chemistry Department, Faculty of Science, Ain Shams University, Egypt. Chemistry Department, Faculty of Science, King Abdulaziz University, Saudi Arabia.

Leer completo en: http://www.sciencedirect.com/science/article/pii/S2090123211000737

Resistencia a compresión y contracción de morteros que contienen diferentes proporciones de adiciones minerales

Three mineral additions largely used in cementitious materials were tested in order to follow the shrinkage behaviour for 1 year of observation when they substitute a part of cement.

The tests were carried out on standardized mortars specimen where cement was replaced by 5%, 15% and 25% of limestone, 10%, 20%, 30% of natural pozzolan and 10%, 30% and 50% of slag. The substitution of cement by 10%, 20% and 30% of limestone powder, natural pozzolan and slag respectively involves an optimal improvement of compressive strength of mortar. The separate quantification of the autogeneous and drying shrinkage development shows the effective contribution of each addition on microstructure modification and of the additional hydrates production. The microstructure was improved in the presence of limestone and of a moderate rate of slag, whereas it remains normal with natural pozzolan. The replacement rate of an active addition lower than 10% led to an additional hydrates production. This overproduction which accompanies the autogeneous shrinkage is more pronounced when cement is largely replaced by limestone. The evolutions of strength and shrinkage of mortars follow the same tendency from where it is easier to find a linear relationship giving the shrinkage deformation according to the compressive strength.

Fuente: *Construction and Building Materials*, August 2011, volume 25, issue 8, pages 3603 – 3609, Ahmed Itim, Karim Ezziane and El-Hadj Kadri. Laboratory LAG, Hassiba Benbouali University, Chlef, Algeria. Laboratory L2MGC, Cergy Pontoise University, France.

Leer completo en:
http://www.sciencedirect.com/science/article/pii/S0950061811001012

Optimización de las propiedades de la ceniza volante para la producción de concreto ligero de alta resistencia

The optimization of properties of lightweight fly ash aggregates for suitability in high-strength lightweight fly ash concrete production was investigated using response surface methodology (RSM). Design-Expert software was used to establish the design matrix and to analyze the experimental data. The relationships between the sintering parameters (temperature, binder content and binder type) and experimentally obtained three responses (specific gravity, water absorption and crushing strength) were established. Also, the optimization capabilities in Design-Expert software were used to optimize the sintering process. Historical data design technique under RSM was performed to optimize the input parameter interactions which showed the best conditions for preparation of fly ash pellets. According to the obtained results, the developed models are statistically accurate and can be used for further analysis. The experimental values agreed with the predicted ones, thus indicating suitability of the model employed and the success of RSM in optimizing the sintering conditions.

Fuente: *Materials and Design*, June 2011, volume 32, issue 6, pages 3586 – 3593, Niyazi Ugur Kockal and Turan Ozturan. Akdeniz University, Department of Civil Engineering, Antalya. Turkey Bogazici University, Department of Civil Engineering, Istanbul, Turkey.

Leer completo en:
www.sciencedirect.com/science/article/pii/S0261306911001063

Efecto de las cenizas volantes en la cinética de la hidratación del cemento Pórtland a diferentes temperaturas de curado

This paper describes the effect of fly ash on the hydration kinetics of cement in low water to binder (w/b) fly ash-cement at different curing temperatures. The modified shrinking-core model was used to quantify the kinetic coefficients of the various hydration processes. The results show that the effect of fly ash on the hydration kinetics of cement depends on fly ash replacement ratios and curing temperatures. It was found that, at 20°C and 35°C, the fly ash retards the hydration of cement in the early period and accelerates the hydration of cement in the later period. Higher the fly ash replacement ratios lead to stronger effects. However, at 50°C, the fly ash retards the hydration of the cement at later ages when it is used at high replacement ratios. This is because the pozzolanic reaction of the large volumes of fly ash is strongly accelerated from early in the aging, impeding the hydration of the cement.

Fuente: *Cement and Concrete Research*, June 2011, volume 41, issue 6, pages 579 – 589, Mongkhon Narmluk and Toyoharu Nawa. Division of Sustainable Resources Engineering, Graduate School of Engineering, Hokkaido University.

Leer completo en:
http://www.sciencedirect.com/science/article/pii/S0008884611000603

Durabilidad de morteros adicionados con cenizas volantes de alto contenido de carbón

En este artículo se presenta un estudio de las propiedades de durabilidad y resistencia a la corrosión de morteros de cemento portland adicionado con ceniza volante (CV) de alto contenido de carbón (19%) en proporciones de hasta un 30% en peso como reemplazo parcial del cemento, utilizando como material de referencia un mortero sin adición. Las propiedades evaluadas en el material sin refuerzo incluyen la resistencia a compresión, absorción y porosidad, absortividad, permeabilidad a cloruros y susceptibilidad a la carbonatación. Para evaluar el comportamiento frente a la corrosión del acero de refuerzo de los morteros se utilizaron ensayos electroquímicos de Resistencia a la Polarización lineal (LPR); estos se llevaron a cabo sobre especímenes expuestos a tres diferentes medios: agua, NaCl 3,5%, para simular condición marina, y CO_2 bajo condiciones controladas (1% CO_2, 65 H.R.% y 25°C). Los resultados mostraron que a 28 días de curado los morteros con 10% de CV presentaron un incremento del 35% en la resistencia a la compresión comparado con el mortero sin adición, a su vez esta mezcla se destaca por su mejor desempeño frente a la corrosión de los aceros estructurales. En términos generales, todos los morteros adicionados presentaron baja permeabilidad a cloruros.

Fuente: *Revista Latinoamérica de Metalurgia y Materiales,* Mayo 2011, volumen 32, Diana M. Burgo, Daniela E. Angulo y Ruby Mejía de Gutiérrez. Escuela de Ingeniería de Materiales, GMC, Universidad del Valle. Colombia.

Leer completo en:
http://www.rlmm.org/ojs/index.php/rlmm/article/view/140

Optimización del cemento y tamaños de las partículas de ceniza volante para producir concretos sustentables

In the drive to produce more sustainable concretes, considerable emphasis has been placed on replacing cement in concrete mixtures with more sustainable materials, both from a raw materials cost and a CO2 footprint perspective. High volume fly ash concretes have been proposed as one potential approach for achieving substantial reductions in cement usage, but their usage is sometimes hampered by reduced early age strengths and dramatically increased setting times. One limitation of the current industry practice is that portland cements are generally only optimized for their performance in a pure cement, as opposed to a blended cement, system. In this paper, a new approach of optimizing the particle sizes of the cement and fly ash for achieving desired performance in a blended product will be presented. By appropriately selecting the particle size distributions of cement and fly ash, equivalent 1 d and 28 d strengths may be achieved with about a 35% volumetric replacement of cement with fly ash, while maintaining the same volume fraction of water in the mixture, thus providing an actual 35% reduction in cement content.

Fuente: *Cement & Concrete Composites*, Article in press, 7 May 2011, Dale P. Bentz, Andrew S. Hansen and John M. Guynn. Engineering Laboratory, National Institute of Standards and Technology Roman Cement LLC, Salt Lake City.

Leer completo en:
http://www.sciencedirect.com/science/article/pii/S0958946511000813

Uso potencial de las escorias de acero en concreto refractario

Steel slags are by-products in the steel production industry and can be used for different purposes; e.g. as aggregates in concrete or asphalt, and for blended cements. In the present study the possible use of electric arc furnace slag from carbon steel production in refractory concrete was studied. It was found that slag undergoes a mineralogical transformation of wustite into magnetite when it is heated to temperatures higher than 800°C, this transformation being accompanied by volumetric expansion, which introduces cracks in the the refractory concrete and drastically worsens its mechanical properties. This transformation is irreversible, so that when slag is heated up to a temperature of 1000°C prior to its use for refractory concrete, the final products exhibit mechanical properties which are comparable to concrete with conventional refractory aggregate, e.g. bauxite.

Fuente: *Materials Characterization*, July 2011, volume 62, issue 7, pages 716 – 723, V. Ducman, A. and Mladenovič. Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana, Slovenia.

Leer complete en:
http://www.sciencedirect.com/science/article/pii/S1044580311000921

Propiedades del concreto conteniendo scoria granulada de horno de fundición (ggbfs) a altas temperaturas

Abstract Normal strength (NSC) and high-performance concretes (HPC) are being used extensively in the construction of structures that might be subjected to elevated temperatures. The behavior of concrete structures at elevated temperatures is of significant importance in predicting the safety of structures in response to certain accidents or particular service conditions. This paper deals with the mechanical properties of concrete made with ground granulated blast furnace slag (GGBFS) subjected to temperatures up to 350 °C. For this purpose, normal concrete having compressive strength of 34 MPa was designed using GGBFS as partial replacement of cement. Cylindrical specimens (150 • 300 mm) were made and subjected to temperatures of 100, 200 and 350°C. Measurements were taken for mass loss, compressive strength, splitting tensile strength, and modulus of elasticity. This investigation developed some important data on the properties of concrete exposed to elevated temperatures up to 350°C.

Fuente: *Journal of Advanced Research*, Article in press, 2011, Rafat Siddique and Deepinder Kaur. Civil Engineering Department, Thapar University, Patiala, Punjab 147004, India
Lee completo en:
http://www.sciencedirect.com/science/article/pii/S2090123211000403

Efectos de las escorias y cenizas de fondo en la permeabilidad del concreto

In this study, the effect of non-ground coal bottom ash (NGCBA) and non-ground granulated blast furnace slag (NGGBFS) on permeability properties regarding durability of concrete is investigated. The mentioned by-products have been used as fine aggregate substitute in the production of concrete. Some permeability–durability tests have been conducted on the specimens produced using these by-product fine aggregates. Tests to be done were chosen as rapid chloride permeability, freezing–thawing and drying–wetting tests. Furthermore, microstructures of these concrete types have been observed. Thus, the effects of chemical, physical and mechanical properties of NGGBFS and NGCBA fine aggregates on the permeability of concrete can be obtained in a much better perspective and discussed easily. The optimum replacement ratio of these by-products as fine aggregate is also attempted to be determined for producing low permeable concrete. Consequently, NGBFS and NGCBA generally increase permeability by increasing porosity due to their physical properties but it can be said that

these by-products as fine aggregate can also reduce permeability of concrete due to their chemical and mechanical properties in terms of permeability–durability tests. Therefore, usage of these by product types improves durability properties related to the permeability of concrete.

Fuente: *Construction and Building Materials*, Article in press, 26 July 2011, Turhan Bilir. Zonguldak Karaelmas University, Faculty of Engineering, Department of Civil Engineering, Turkey.

Leer completo en: http://www.sciencedirect.com/science/article/pii/S0950061811003503

Energía
Sistemas de almacenamiento para micro redes

Investigación de micro redes con inversor de corriente directa y corriente alterna, conectada a la distribución de recursos energéticos

With the increasing use of renewable energy resources and energy storage devices, inverter-based distributed energy resources (DERs) become the important components in microgrids. As diesel generators with direct ac connections are the current most cost effective and reliable power sources, the stability investigation of microgrids should include both types of DERs. In this paper, dynamics of diesel generation will be included and the interaction of the diesel generators and the inverter-based DERs will be investigated using eigenvalue analysis and time-domain simulations. The significant contributions of this paper include: 1) identification of the stability problem in microgrids with inverter-based DERs and conventional generators and 2) investigation of the interaction problem of inverter-based DERs and conventional generators in islanded microgrids.

Fuente: *Power Delivery*, IEEE Transactions, Jul 2011, volume 26, issue 3, pages 1634 – 1642, Zhixin Miao; Domijan, A.; Lingling Fan

Leer completo en: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5738709

Controlar el reparto de energía eléctrica entre los inversores del lado de la carga en corriente directa de la micro red para energía eléctrica de súper alta calidad en el sistema de distribución

A DC microgrid is a novel power system using DC distribution in order to provide superhigh-quality electric power. The DC distribution system is suitable for DC-output distributed generation such as photovoltaic and fuel cells, and energy storage devices such as batteries and electric double layer capacitors. Power is distributed through a DC distribution line and converted to the required AC or DC voltage by converters placed near the loads. Load-side single phase converters are connected through transformers in order to share active and reactive power. In this paper, a power sharing control scheme is proposed, and the power sharing characteristics are demonstrated by experimental results.

Fuente: *Electrical Engineering in Japan*, 2011,Volume, 176, issue 1, pages 55 – 64,Hiroaki Kakigano, Kaho Nada, Yushi Miura, Toshifumi Ise and Ryohei Uchida.
Osaka University, Japan.
Leer completo en:
http://onlinelibrary.wiley.com/doi/10.1002/eej.21052/pdf

Control de carga-frecuencia de una micro red autónoma con generación eólica e hidráulica

This paper presents an aggregate load-frequency controller for an autonomous microgrid (MG) with wind and hydro renewable energy sources. A micro-hydro power plant with a synchronous generator (SG) and a wind power plant with an induction generator (IG) supply the MG. Both generators directly feed power into the grid without the use of additional power electronics interfaces, thus the solution becoming robust, reliable and cost-effective. An original electronic load controller (ELC) regulates the MG frequency by a centralized load-frequency control method, which is based on a combination of smart load (SL) and battery energy storage system (BESS). SL and BESS provides the active power balance for various events that such systems encounter in real situations, both in cases of energy excess production and energy shortage. Moreover, the proposed ELC includes an ancillary function to compensate the power unbalance produced by the uneven distribution of the single-phase loads on the MG phases, without the use of extra hardware components. A laboratory-scale prototype is used for experimentally assessment of the proposed solutions. The experimental results emphasize the effectiveness of the ELC while also showing its limit.

Fuente: *Renewable Energy*, December 2011, volume 36, issue 12, pages 3345 – 3354, 8, I. Serban and C. Marinescu.
Transilvania University of Braşov, Department of Electrical Engineering, Eroilor 29, 500036 Braşov, Romania.

Leer completo en: http://www.sciencedirect.com/science/article/pii/S0960148111002382

Sistema de gestión de energías inteligentes para una óptima operación económica de una micro red

This study presents a smart energy management system (SEMS) to optimise the operation of the microgrid. The SEMS consists of power forecasting module, energy storage system (ESS) management module and optimisation module. The characteristic of the photovoltaics (PV) output in different weather conditions has been studied and then a 1-day-ahead power forecasting module is presented. As energy storage needs to be optimised across multiple-time steps, considering the influence of energy price structures, their economics are particularly complex. Therefore the ESS module is applied to determine the optimal operation strategies. Accordingly, multiple-time set points of the storage device, and economic

performance of ESS are also evaluated. Smart management of ESS, economic load dispatch and operation optimisation of distributed generation (DG) are simplified into a single-object optimisation problem in the SEMS. Finally, a matrix real-coded genetic algorithm (MRC-GA) optimisation module is described to achieve a practical method for load management, including three different operation policies and produces diagrams of the distributed generators and ESS.

Fuente: *IET Renewable Power Generation*, 2011, volume 5, pages 258 – 267, C. Chen, S. Duan, T. Cai, B. Liu and G. Hu.

Leer completo en: http://ieeexplore.ieee.org/xpls/abs_ all.jsp?isnumber=5743061&arnumber=5743067

Control y operación de un micro red DC con generación variable y almacenamiento de energía

Control and operation of a DC microgrid, which can be operated at grid connected or island modes, are investigated in this paper. The DC microgrid consists of a wind turbine, a battery energy storage system, DC loads, and a grid-connected converter system. When the system is grid connected, active power is balanced through the grid supply during normal operation to ensure a constant DC voltage. Automatic power balancing during a grid AC fault is achieved by coordinating the battery energy storage system and the grid converter. To ensure that the system can operate under island conditions, a coordinated strategy for the battery system, wind turbine, and load management, including load shedding, are proposed. PSCAD/EMTDC simulations are presented to demonstrate the robust operation performance and to validate the proposed control system during various operating conditions, such as variations of wind power generation and load, grid AC faults, and islanding.

Fuente: *IEEE Transactions on Power Delivery*, 2011, volume PP, issue 99, Lie Xu and Dong Chen.

Leer completo en: http://ieeexplore.ieee.org/search/srchabstract.jsp?tp=&arnumber=5951822&queryText%3DControl+and+Operation+of+a+DC+Microgrid+With+Variable+Generation+and+Energy+Storage%26openedRefinements%3D%26filter%3DAND%28NOT%284283010803%29%29%26searchField%3DSearch+All*

Sistema multiagente para optimización de micro redes

Microgrids are low voltage networks usually located at the consumer end of the distribution system. It typically consists of consumer loads, energy storage and small generation systems and is capable of islanding to protect itself against grid supply interruption. With the increased wareness of clean energy power systems, renewable technologies such as solar PV, wind turbines and fuel cells are gradually emerging within the power system network, and control and management for these equipment are necessary to ensure the stable operation of microgrids. However, existing centralized control systems are unable to handle the large number of renewable components and thus, a decentralized control scheme called Multi-Agent System (MAS) is introduced to manage these components. The implementation of distributed control will include JADE as the platform for agent communications as well as developing customizable agents for specific microgrid requirements such as ancillary services, power trading and negotiation and network security.

Fuente: *IEEE*, Jun 2011, Foo Y.S. Eddy and Gooi H.B., School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore.

Leer completo en: http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=05944510

Mejora de las políticas de administración de energía en edificios basada en la simulación

The technology advances in distributed power generation, cogeneration of cooling, heat and power, storage devices and micro grid provide the opportunity to better manage the power in buildings in order to save power, and to reduce the CO_2 emission. Due to the complexity of such a multi-energy system, simulation is usually the only faithful way to accurately describe the system dynamics and for performance evaluation. However, simulation is usually time-consuming and provides only noisy observations. Thus finding the optimal power management policy is nontrivial. In this paper, a joint schedule problem is considered to schedule solar power, wind power, combined cooling, heating, and power generation (CCHP), battery, and high temperature chiller in order to satisfy the load on electricity, sensible heat load, and latent heat load in buildings with the minimal average cost. The rollout method is applied to improve from given base policies through simulations. Numerical results show that the method obtains policies better than the base policies.

Fuente: *IEEE*, May 2011, Qing-Shan Jia, Jian-Xiang Shen, Zhan-Bo Xu, Xiao-Hong Guan.

Leer completo en: http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=05899199

Construyendo un laboratorio de micro redes

Microgrids are local area power systems, and are attracting increased attention due to their potential to provide a solution to integrate renewable energy into the wider grid. In order to facilitate experimental research, a microgrid laboratory has been built by CSIRO in Australia. Experiments have been carried out which investigate issues of integrating distributed generation, including renewable energy, into the electricity network. This paper describes some of the challenges involved in setting up such a facility and provides examples of experimental results. This facility is unique in its incorporation of three types of solar PV technologies, two types of wind power, three types of battery storage, and a programmable load bank. The availability of a flexible facility such as this is essential in advancing the science in this area, and is leading to valuable insights into microgrid operation.

Fuente: *IEEE*, June 2011, D. J. Cornforth, A. Berry, and T. Moore, CSIRO Energy Transformed Flagship, Mayfield West, NSW, Australia.

Leer completo en: http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=05944501

Avances en la electrónica de potencia y unidades de interfaz con el crecimiento recursos de energía renovable

The whole world is now concentrating on advancing their pool of renewable energy resources. Immense growth has happened in the field of renewable energy and the energy harvesting methods in the past decade. It is estimated that there is still a huge potential of growth remaining in the field of renewable energy resources in the coming years. Generation of renewable energy at the source end to the transmission of the energy to the utility end is done at various interstates coupled with power electronic equipments and systems. Applications of power electronics are expanding at a high pace in industrial power generation, utility, grid integration, and transmission environments due to the advancements in technology and reduction in cost and size of the components and systems. There are numerous multistage converters and inverters topologies being developed for processing and delivering the gigawatt level of renewable power being produced. This paper highlights the growth of power electronics starting from semiconductor type switching devices to various multistage topologies which will extensively contribute to the development and growth of renewable energy resources around the globe. It is a fact that power electronics is an integral part of renewable energy generation and utilization and its optimization of size, cost, and performance is necessary for the most efficient harvesting. Latest advancements in the various ratings of switching devices and components are discussed in the paper. Proper topology based implementation of power electronics and motor drives in the generation of various renewable energy sources such as solar power, wind power, fuel cells, biomass, and other energy storage elements are discussed in details. Individual sources of renewable energy resources interfaced with multistages of power electronic systems are elaborated in the paper.

Fuente: *Renewable and Sustainable Energy Reviews*. Elsevier, May 2011, volume 15, issue 4, pages 1816 – 1827, Arindam Chakraborty. PhD Research Candidate ('04–'07), IIT, Chicago, IL, United States

Leer completo en: http://www.sciencedirect.com/science/article/pii/S1364032110004363

Sistema de almacenamiento de baterías y ultracondensadores administrando la energía dinámica en micro red

Renewable-energy-basedmicrogrids are a better way of utilizing renewable power and reduce the usage of fossil fuels. Usage of energy storage becomesmandatory when such microgrids are used to supply quality power to the loads. Microgrids have two modes of operation, namely, grid-connected and islanding modes. During islanding mode, the main responsibility of the storage is to perform energy balance. During grid-connected mode, the goal is to prevent propagation of the renewable source intermittency and load fluctuations to the grid. Energy storage of a single type cannot perform all these jobs efficiently in a renewable powered microgrid. The intermittent nature of renewable energy sources like photovoltaic (PV) demands usage of storage with high energy density. At the same time, quick fluctuation of load demands storage with high power density. This paper proposes a composite energy storage system (CESS) that contains both high energy density storage battery and high power density storage ultracapacitor to meet the aforementioned requirements. The proposed power converter configuration and the energy management scheme can actively distribute the power demand among the different energy storages. Results are presented to show the feasibility of the proposed scheme.

Fuente: *IEEE Transactions on Power Electronics*, 2011, volume 26, issue 3, pages 923 – 930, Haihua Zhou, Bhattacharya, T.; Duong Tran; Siew, T.S.T.; Khambadkone, A.M. Dept. of Electr. & Comput. Eng., Nat. Univ. of Singapore, Singapore, Singapore.

Leer completo en: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5645693

Corrosión

Mitigación de la corrosión interna en ductos

Oxidación interna y transformaciones de fase de aleaciones inducidas Fe-Ni-Al y Fe-Ni-Cr-Al por corrosión KCl

The corrosion of two multiphase Fe–Ni–Al and Fe–Ni–Al–Cr alloys is studied at 650°C in KCl-contaminated air. The oxidation rate of the alloys in air alone is low. When KCl is introduced, the corrosion is accelerated, producing a thick external scale of iron oxides, an intermediate layer of spinel, and a region of internal oxidation of Al. Potassium chromate is detected on Fe–Ni–Al–Cr surface that accounts for the degradation of protective chromia. An Al-depleted single phase region is observed in the front of the internal oxidation, due to the selective consumption of Al via an ''active oxidation'' process.

Fuente: *Corrosion Science*, June 2011, volume 53, issue 6, pages 2115 – 2121, T.J. Pan, Y.S. Li, Q. Yang, R.F. Feng and A. Hirose.

Leer completo en: http://www.sciencedirect.com/science/article/pii/ S0010938X11001314

Inspección basada en riesgo para las operaciones de una refinería. Caso de negocio para el RBI en la refinería BPCL KOCHI

In cooperation with engineers at the Kochi refinery, Meridium proceeded with BPCL's Asset Integrity Management System (AIMS) Project in 2008. Phase 1 of the AIMS Project involved implementation of Meridium's core functionality as well as in-

spection management and thickness monitoring (corrosion analysis) functionalities. The Phase 1 functional design specification (FDS) was completed in November 2008, followed by conference room pilot (CRP) and training in February 2009 and achievement of the "go-live" milestone in March 2009.

Fuente: *Meridium APMAdvisor*, 2011, Rene González.

Leer completo en:
http://www.apmadvisor.com/article.asp?id=255

Selección de los componentes de un sistema fluido para su uso en campos petrolíferos amargos

Selecting Fluid System Components For Use In Sour Oilf elds The conditions under which oil and gas are brought from their reservoirs to the surface can be outright hostile to many common materials used in fluid system components employed in the industry. Potentially dangerous mechanisms include localised corrosion, Stress Corrosion Cracking (SCC), and Sulfi de Stress Cracking (SSC). SSC has become increasingly dominant as more sour reservoirs are being developed – for example, those in the northern part of the Caspian Sea that contain up to 20% of hydrogen sulfide (H_2S). Aging reservoirs can also turn sour as abiotic and biotic reactions take place. This article describes how to select the optimal materials of construction for components that need to perform reliably for many years in the demanding sour environments of oil and gas exploration and production.

Fuente: *SPE News*, May 2011, issue 144, Corrosion Technology, pages 10 – 12, Gerhard Schiroky, Senior Scientist, Swagelok.

Leer completo en: http://www.spe-wa.org/useruploads/files/FKv4tY_spe144_web.pdf

Evaluación de los mecanismos de corrosión presentes en las líneas de producción de crudo y gas ubicadas en el noreste de Venezuela

En este trabajo se realizó un estudio in situ en instalaciones de producción de hidrocarburo ubicadas en el noreste de Venezuela, con el fin de evaluar la influencia de la dinámica del fluido presente en las líneas de producción de crudo y gas, sobre los mecanismos de corrosión interna generados por la presencia de los gases CO_2 y H_2S. Para ello se dispuso de una herramienta nueva diseñada por PDVSA-Intevep, para monitorizar la corrosión y realizar un estudio exhaustivo en condiciones reales de operación. Los resultados obtenidos muestran que el tipo de degradación predominante es corrosión bajo depósito, lo cual genera daños localizados (picaduras) en diferentes posiciones internas de las líneas de producción y, de acuerdo a los análisis microscópicos, dichos depósitos sólidos están relacionados con la presencia de arena, carbonatos y sulfuros de hierro. La ubicación de los daños está asociada a las condiciones hidrodinámicas presentes en el sistema de producción como lo son el patrón de flujo y las velocidades superficiales del líquido y del gas, entre otros.

Fuente: *Revista Latinoamericana de Metalurgia y Materiales*, 2012, Número 31, José Biomorgi, Samuel Hernández, Jairo Marín, Erik Rodríguez, Milton Lara, Alfredo Viloria. PDVSA-Intevep. Urbanización Santa Rosa. Sector El Tambor. Los Teques. Estado Miranda. Apartado 76343, Caracas 1070A, Venezuela

Leer completo en: http://www.rlmm.org/ojs/index.php/rlmm/article/view/178/194

Formación de hidratos y su influencia en la corrosión interna de un gaseoducto natural

This study establishes the ability of hydrate formation to initiate internal corrosions along natural gas pipelines. The identified corrosion types, which are cavitations, erosion and corrosions by chemical reactions, are capable to individually or collectively initiate pitting and stress cracking corrosions which are also dangerous to gas pipelines. The impacts of these corrosion types are classified to economics, environmental and human loss with the economic loss as much as US$3 trillion depending on the pipe-length, location, sea depth, wave function, climatic conditions and political situations. Various predictive measures to minimize hydrate formations are finally recommended.

Fuente: *Nafta Scientific Journal*, June 2011, volume 62, No. 5 – 6, pages 164 – 173, Emmanuel O. Obanijesu, Vishnu Pareek, Rolf Gubner and Moses O. Tade.

Leer completo en: http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=104431&lang=en

Monitoreo por emisión acústica de grietas producidas por H_2S en aceros de ductos: aplicación en grietas inducidas por hidrógeno

Acoustic emission (AE) was used for monitoring steel cracking during exposure to wet hydrogen sulfide (H_2S) environments. A method for filtering AE data related to hydrogen-induced cracking (HIC) was presented and applied for several case studies. In a series of tests on unstressed sweet service steels, evolution of AE indicated three successive HIC phases. An initial incubation period corresponded to hydrogen entry in the steel, during which no cracking occurred. Then two cracking phases were detected. The first was associated with decohesion of weak steel interphases. The second was identified as crack propagation under high internal hydrogen pressure. Crack propagation decreased and eventually ceased over time. Analysis of AE data was then used to evaluate the extent of HIC after sour exposure. Correlation was found when appropriate data filtering was applied. AE analysis was also applied to sour service steels under an applied load. The first steel exhibited HIC AE signals. Its fracture surface was typical of a stress-oriented hydrogen-induced cracking (SOHIC) mode of failure, in good agreement with AE results. For the second steel, which also failed during the test, no AE related to HIC was detected. Fracture surface was typical of sulfide stress cracking (SSC), also in good agreement with AE findings.

Fuente: *Corrosion*, 2011, *Corrosion Science*, volume 67, issue 6, V. Smanio, J. Kittel, M. Fregonese, T. Cassagne, B. Normand, and F. Ropital.

Leer completo en:
http://corrosion.aip.org/resource/1/corrak/v67/i6/p065002_s1?isAuthorized=no

Corrosión de ductos de transporte por CO_2 – el efecto del ingreso de agua

Both field experience and lab data indicate that the corrosion rate of carbon steel in pure dense phase CO_2 is near zero if no free water is present. The question is whether this also applies when other contaminants like SO_x, NO_x, H_2S and O_2 are present in moderate amounts. In a pipeline network with different types of CO_2 sources, the commingling of streams with various impurities can give a very complex mixture, and side reactions like oxidation and decomposition of impurities can be foreseen. An important issue is how the contaminants partition between the various phases during pressure reduction and when free water is present. The corrosion mechanisms under these conditions are not well understood, and it becomes more and more uncertain what will happen when the concentration of contaminants including water increases. The paper addresses these issues and discusses recent corrosion flow loops and autoclaves results obtained in an ongoing sub-sea CO_2 transmission pipeline project.

Fuente: *Energy Procedia*, 2011, volumen 4, pages 3063 – 3070, Arne Dugstad and Bjørn Morland. Institute for Energy Technology (IFE), PO. Box 40, 2027 Kjeller, Norway. Gassco AS, PO. Box 93, N-5501 Haugesund, Norway

Leer completo en:
http://www.sciencedirect.com/science/article/pii/S1876610211004152

El impacto de la concentración de SO_2 en el índice de corrosión del acero X70 y de hierro en presencia de CO_2 supercrítico saturado con agua y SO_2

The corrosion behavior of X70 steel and iron in water-saturated supercritical CO_2 mixed with SO_2 was investigated using weight-loss measurements. As a comparison, the instantaneous corrosion rate in the early stages for iron in the same corrosion environment was measured by resistance relaxation method. Surface analyzes using SEM/EDS, XRD and XPS were applied to study the morphology and chemical composition of the corroded sample surface. Weight-loss method results showed that the corrosion rate of X70 steel samples increased with SO_2 concentration, while the corrosion rate increased before decreasing with SO_2 concentration for iron sample. Comparing resistance relaxation method results with weight-loss method results, it is found that the instantaneous corrosion rate of iron is much higher than the uniform corrosion rate of the iron tablet specimens which are covered with thick corrosion product films after a long period of corrosion. The corrosion product films were mainly composed of $FeSO_2$ and $FeSO_2$ hydrates. The possible reaction mechanism under such environment was also analyzed, and the electrochemical reaction between the dissolved SO_2 in the condensed water film with iron is the critical reaction step.

Fuente: *The Journal of Supercritical Fluids*, Article in Press, 20 June 2011, Yong Xiang, Zhe Wang, Chao Xu, Chengchuan Zhou, Zheng Li and Weidou Ni. State Key Laboratory of Power Systems, Department of Thermal Engineering, Tsinghua University, Beijing, 100084, PR China.

Leer completo en: http://www.sciencedirect.com/science/article/pii/S0896844611002294

PATENTES

Esta sección recopila patentes de diversas fuentes, mismas que son identificadas en cada caso. Los documentos referidos pueden ser de acceso restringido. Si alguna patente es de su interés, favor de contactar a:
→Dra. Tamara Alcántara (55) 5623 3500 ext. 1070 / alcantarati@yahoo.com.mx

Materiales
Durabilidad del Concreto

A composition suitable for use in building construction
No Publicación: WO/2011/058574
Inventores: VASANT, Joshi, Pradeep
Compañía: VASANT, Joshi, Pradeep

The present invention provides a composition suitable for use in a building construction wherein said composition comprises water, a thickener, a pH stabilizer, a preservative, a coalescing agent, an anionic pre-polymerized binder, bottom ash, silica particle mixture, stone grit, a filler and an extender. The invention also provides a process for manufacturing of the composition. The invention provides the composition which is environmental friendly, Portland cement free, wet mix in ready to use form with extended pot life and shelf life. The composition prepared in accordance with the present invention is used as a mortar, a plaster/render, repair mortar, grouting mortar and as crack filler.

Fuente:
http://www.wipo.int/patentscope/search/en/detail.jsf?docId=WO2011058574&recNum=1&docAn=IN2010000024&queryString=ALLNUM:%28WO/2011/058574%29&maxRec=1

Concrete composition
No Publicación: WO/2011/073272
Inventores: AL-ANSARY, Marwa
Compañía: Shell Internationale Research Maatschappij B.V

A concrete composition comprising a mouldable mixture of aggregate, binder and liquid vehicle, wherein the aggregate comprises sulphur concrete-derived aggregate and wherein the binder comprises hydraulic binder. The use of crushed sulphur concrete as aggregate in cement-based concrete reduces the hardening time of the concrete.

Fuente:
http://www.wipo.int/patentscope/search/en/detail.jsf?docId=WO2011073272&recNum=1&docAn=EP2010069791&queryString=ALLNUM:%28WO/2011/073272%29&maxRec=1

Inorganic binder system for the production of chemically resistant construction chemistry products
No Publicación: WO/2011/064005
Inventores: ELLENRIEDER, Florian
Compañía: Construction Research & Technology Gmbh

A novel binder system comprising at least one latent hydraulic binder, at least one amorphous silica, optionally at least one reactive filler and at least one alkali metal silicate is proposed. It was surprisingly found that the binder system according to the invention hardens in the form of a hybrid matrix which is acid-resistant, water-resistant and alkali-resistant. The binder system can be used for the production of a hydraulically setting mortar which, after setting, hardening for seven days and subsequent storage for three days in acid, base and/or water, has compressive strengths of more than 15 N mm-2, preferably more than 20 N mm-2 and in particular more than 25 N mm-2, according to DIN EN 13888.

Fuente:
http://www.wipo.int/patentscope/search/en/detail.jsf?docId=WO2011064005&recNum=1&docAn=EP2010063386&queryString=ALLNUM:%28WO/2011/064005%29&maxRec=1

Protective coatings and methods of making and using the same
No Publicación: WO/2011/062880
Inventores: JING, Naiyong
Compañía: 3M Innovative Properties Company

Protective coatings are formed on a reflective surface of a substrate by depositing an aqueous coating composition including dispersed silica-containing nanoparticles, and removing at least a portion of the aqueous phase. In some embodiments, the aqueous coating composition includes an acid having a pKa of < 3.5 in an amount effective to produce a pH of less than 5. In other embodiments, the aqueous coating composition includes at least one dispersed (co)polymer, which in some embodiments, forms core-shell particle having a dispersed (co)polymer core surrounded by a shell consisting essentially of silica nanoparticles. In some of these embodiments, the pH is at least 5. Also described are methods of making and using the coating compositions to impart soil and stain accumulation resistance and easy cleaning characteristics to light reflective substrates such as construction articles (e.g., roofing materials), light reflective surfaces (e.g. reflective films) and light transmissive surfaces (e.g., photovoltaic cells).

Fuente:
http://www.wipo.int/patentscope/search/en/detail.jsf?docId=WO2011062880&recNum=1&docAn=US2010056773&queryString=ALLNUM:%28WO/2011/062880%29&maxRec=1

Energía
Sistemas de almacenamiento para micro redes

Electricity storage device and method for manufacturing electricity storage
No de Publicación: WO/2011/068086
Inventores: ARAKI, Shuichi; (JP), TAKEDA, Masami; (JP)., SUGIHASI, Yuji; (JP), TSUCHIYA, Takayuki; (JP).
Compañía: UD Trucks Corporation [JP/JP]

Disclosed is an electricity storage device comprising an electricity storage module that is composed of a plurality of electricity storage cells that are respectively packaged in resin cases. The electricity storage device is provided with: a flexible tube that is fused to the respective cases so as to be connected to the electricity storage cells for the purpose of discharging a gas therefrom; and a valve that allows or stops the discharge of the gas from the tube. Consequently, the electricity storage device has achieved a gas vent pipe system that has high sealing performance.

Fuente:
http://www.wipo.int/pctdb/en/fetch.jsp?LANG=ENG&DBSELECT=PCT&SERVER_TYPE=19-10&SORT=41318294-KEY&TYPE_FIELD=256&IDB=0&IDOC=3000935&C=10&ELEMENT_SET=B&RESULT=1&TOTAL=1&START=1&DISP=25&FORM=SEP-0/HITNUM,B-ENG,DP,MC,AN,PA,ABSUM-ENG&SEARCH_IA=JP2010071231&QUERY=%28WO%2fWO%2f2011%2f068086%29

Battery and method for operating a battery
No de Publicación: WO/2011/070006
Inventores: Landes, Harald; (DE), ZAMPIERI, Alessandro; (DE).
Compañía: Siemens Aktiengesellschaft [De/De

The invention relates to a battery comprising a cathode and an anode, between which a solid electrolyte is disposed. The battery comprises a process gas feed on the cathode side. The battery is characterized in that an electrically conductive supporting body is disposed on the cathode surface, comprising in turn at least one chamber connected to the anode, comprising a porous, oxidizable material and a redox pair that is gaseous at an operating temperature of the battery.

Fuente:
http://www.wipo.int/pctdb/en/fetch.jsp?LANG=ENG&DBSELECT=PCT&SERVER_TYPE=19-10&SORT=41326760-KEY&TYPE_FIELD=256&IDB=0&IDOC=3013895&C=10&ELEMENT_SET=B&RESULT=1&TOTAL=1&START=1&DISP=25&FORM=SEP-0/HITNUM,B-ENG,DP,MC,AN,PA,ABSUM-ENG&SEARCH_IA=EP2010069059&QUERY=WO%2f2011%2f070006

High performance energy storage and collection devices containing exfoliated microtubules and spatially controlled attached nanoscale particles
No. de Publicación: US2011/0151321
Inventores: Bosnyak, Clive P. (Dripping Springs, TX, US)
Compañía: Designed Nanotubes, LLC (Austin, TX, US)

The present disclosure relates to energy storage or collection devices and methods for making such devices having electrode materials containing exfoliated nanotubes with attached electro- or photoactive nanoscale particles or layers. The exfoliated nanotubes and attached nanoscale particles or layers may be easily fabricated by methods such as coating, solution or casting or melt extrusion to form electrodes. Electrolytes may also be used for dispersing nanotubes and also in a polymeric form to allow melt fabrication methods.

Fuente:
http://appft1.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PG01&p=1&u=%2Fnetahtml%2FPTO%2Fsrchnum.html&r=1&f=G&l=50&s1=%20220110151321%22.PGNR.&OS=DN/20110151321&RS=DN/20110151321

Corrosión
Mitigación de la corrosión interna en ductos

Sistemas y métodos para la detección de anomalías en superficies internas de estructuras alargadas y huecas con el dominio del tiempo o la reflectometría de dominio de frecuencia.
No Publicación: US7,940,061 B2
Inventores: Ronald J. Focia; Charles A. Frost.
Compañía: Technologies Inc.

Systems and methods for detecting anomalies, such as corrosion, on internal surfaces of hollow elongate bodies, such as pipelines. The pipeline is treated as a circular waveguide, and a fast rise time pulse or a spectrum of electromagnetic waves is launched down the waveguide to perform time domain, or equivalent of time domain (e.g., frequency domain), reflectometry. Anomalies in the internal structure of the pipeline cause reflections which can be measured and related to the physical parameters of the pipeline structure and identified to a particular location.

Fuente:
http://patents.uspto.gov/web/patents/patog/week19/OG/html/1366-2/US07940061-20110510.html

Inhibidores anticorrosivos para aplicaciones petroleras
No de Publicación: PCT/US2008/087600
Inventores: Yang, Jiang; Jovancicevic, Vladimir.
Compañía: Baker Hughes Incorporated.

Imidazoline dimer-type compounds which are prepared by the reaction of dimer fatty acid and a dialkylene triamine, such as diethylenetriamine (DETA), are useful for corrosion inhibition in water-containing fluids contacting metal, particularly fluids containing CO_2 and/or H_2S. When the reaction is conducted with molar excess of the polyamine, the resulting imidazoline dimer or oligomer is surprisingly more effective at corrosion inhibition than conventional monomeric imidazoline. Also unexpected is the better water solubility of the reaction product as compared with the conventional monomeric imidazoline.

Fuente:
http://www.wipo.int/patentscope/search/en/WO2009088702

Método de mitigación de la velocidad de corrosión de productos tubulares de yacimientos de petróleo.
No de Publicación: PCT/US2010/054105
Inventores: Evans, Brian; Seth, Kushal; Gabrysch, Allen, D.; Kelly, Patrick, A.; Horner, Donald, Nelson, Jr.
Compañía: Baker Hughes Incorporated.

Acid-soluble cupric acetate may used in conjunction with potassium iodide to generate cuprous iodide (CuI) as an acid corrosion inhibition aid. A suitable corrosion inhibitor together with the aid protects steel surfaces in an acid environment, for instance, while acid fracturing or matrix acidizing subterranean formations. Cupric acetate monohydrate may be used with an alkali metal iodide salt such as potassium iodide or sodium iodide to generate cuprous iodide in situ. In aqueous acid solutions. Use of cupric acetate provides a somewhat delayed reaction rate with potassium iodide to generate the desired product, cuprous iodide, which has very low solubility in acid systems. The method includes delayed and in situ production of cuprous iodide for enhancing performance of commercially available corrosion inhibitors, commonly referred to as intensifying the effect of the corrosion inhibitor (corrosion inhibitor intensifier or simply an intensifier).

Fuente:
http://www.wipo.int/patentscope/search/en/WO2011053585

EVENTOS

Materiales
Durabilidad del Concreto

65th RILEM Week
04 - 07 septiembre 2011
Hong Kong, China

Más información:
http://www.rilem.net/gene/main.php?base=600040#next_333

International Conference on Advances in Construction Materials Through Science and Engineering
05 - 07 September 2011
Hong Kong SAR, China

Más información:
http://www.rilem.net/gene/main.php?base=600040#next_333

4th International Conference on Concrete Repair - Concrete Solutions
26 - 28 septiembre 2011
Dresden, Germany

Más información:
http://www.rilem.net/gene/main.php?base=600040#next_333

Concrete 2011- Building and Sustainable Future
12-14 octubre 2011
Australia

Más información:
http://www.concrete2011.com.au

Energía
Sistemas de almacenamiento para microredes

Seminario: Hybrid Wind / PV/ Storage Systems and Micro Grids Fundamentals – Extended
12 – 16 de septiembre 2011
Berlín, Alemania

Más información:
http://www.renewableenergyworld.com/rea/partner/renewables-academy-ag-renac

Gridweek2011, Defining Smart Grid's Future, today
12 – 15 de septiembre de 2011
Washington, DC, EUA

Más información:
http://www.icsgce.com/

5TH IPQC Energy Storage Summit
26 – 28 de septiembre 2011
Houston, Texas, EUA

Más información:
http://www.energystoragesummit.com

EV Battery Tech USA 2011
27 – 28 de septiembre 2011
Troy, Michigan, EUA

Más información:
http://www.ev-battery-tech.com/

Batteries 2011
28 – 30 de septiembre 2011
Cannes, Francia

Más información:
http://www.batteriesevent.com/

IEEE International Conference on Smart Grid and Clean Energy Tech
27 – 30 de septiembre de 2011
Chengdu, China

Más información:
http://www.icsgce.com/

Corrosión
Mitigación de la corrosión interna en ductos

2011 AF Corrosion Conference
16 -18 agosto 2011
Georgia, EUA

Más información:
http://afcpo.com/

NACE Central Area Conference 2011
28 - 31 agosto 2011, Texas, USA

Más información:
http://events.nace.org/sarwebsites/centralarea/conference11/index.asp

Eurocorr 2011
04 - 08 de septiembre 2011
Estocolmo, Suecia

Más información:
http://www.eurocorr.org/EUROCORR+2011.html