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10 al 14 de Noviembre del 2013, Acapulco, Gro.

ROC&C'2013

México, D. F. a 25 de Septiembre de 2013.

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Estimada ***PhD. Valero***:

Nos es muy grato informar a usted, que su ponencia ha sido aceptada, para ser presentada en la VIGESIMACUARTA REUNION INTERNACIONAL DE OTOÑO DE COMUNICACIONES, COMPUTACION, ELECTRONICA, AUTOMATIZACION, ROBOTICA Y EXPOSICION INDUSTRIAL **ROC&C'2013**, a celebrarse del **10 al 14 de Noviembre del 2013**, en el *Centro Internacional Acapulco, Gro., México*, para lo cual agradeceremos se sirva enviar por fax y/o correo el siguiente documento debidamente firmado.

Ing. Vicente Núñez González
Director Ejecutivo
IEEE Sección México
Presente.

CARTA COMPROMISO

Mediante este documento y de acuerdo con los ESTATUTOS DEL IEEE me comprometo a presentar personalmente la ponencia cuyo título es,

4.- ELECTROCHEMICAL MOTORS

o bien, enviar a un representante *con conocimientos suficientes del tema*, notificando al IEEE, de este cambio, ***por lo menos 15 días antes del evento.***

Atentamente,

PhD. L. Valero[1] / PhD. T.F. Otero[2] / PhD. J. Arias Padilla[2]

IMPORTANTE: Para realizar los TRAMITES DE INSCRIPCIÓN AL EVENTO Y AL HOTEL con mucho gusto, le anexamos la documentación correspondiente.

El **IEEE Sección México** le extiende una muy cordial invitación a participar como *Moderador* en esta **ROC&C'2013**, moderando algunas de las *Sesiones Técnicas de su interés y especialidad*. En caso de aceptar ayudarnos, le suplicamos nos lo comunique, para considerarlo en el Programa Técnico.

Sin otro particular de momento, aprovechamos la ocasión para enviarle un cordial saludo y expresarle nuestro reconocimiento y gratitud por participar en la **ROC&C'2013**.

Atentamente,

Ing. Vicente Núñez González
Director Ejecutivo

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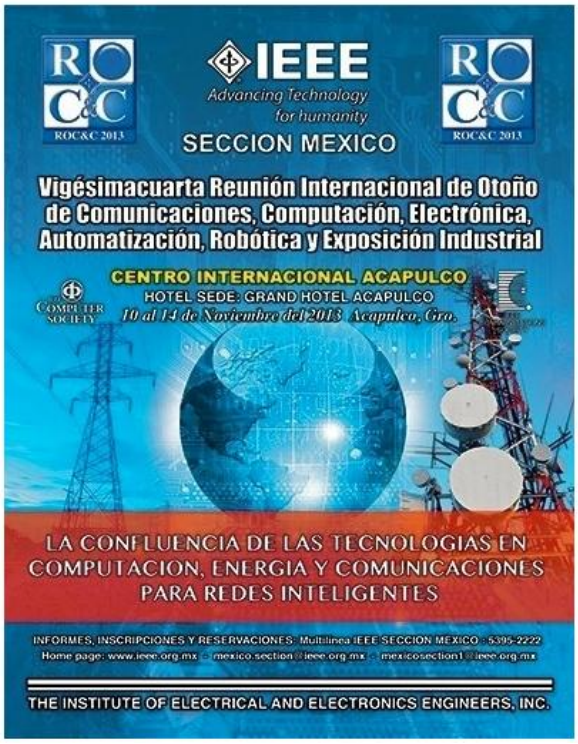

Memoria Técnica

Computación

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CP-02
PON 04

Electrochemical motors

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Abstract:
The synthesis of molecular motors and their design into devices that mimic biological structures such as artificial muscles have created an increasing scientific and technological interest for many years. Slow movements in conducting polymer actuators are electrochemical motors, actuators based in conducting polymers and working at low frequency are electrochemical motors and are emerging technologies aplied to differents areas. The electrochemical stimulation of conformational movements in polymeric chains constitutes the basic molecular motor Macroscopic bending movement rates, direction of the movement, described angles and final position are under faradic control of the involved current and charge, as corresponds to any electrical machine. Angular movement rates and described angles are quantitatively controlled by the oxidation rate per unit of weight, as it corresponds to electrochemical devices working under faradic conditions.

Keywords: angles, angular rates, conducting polymer motors, electrochemical motors polymeric actuators.

Introduction

Great efforts are being done in order to describe and to develop theoretical models quantifying the those devices are considered to work under control of physical processes very complex equations are obtained to describe the movements, accounting the mechanical, electrical or chemical properties and geometric parameters of conducting polymer films taking part of bilayer [1, 2] or trilayers devices [3-8]. Volume variation in films of conducting polymers and the subsequent development of actuators are expected to be under control of the driving electrochemical reactions.

For those conducting polymers interchanging anions during reactions, for charge balance, between the film and the solution, the polymer film swells during oxidation and shrinks during reduction according with reactions:

$$(pPy^{0})_s + n(Cl^-)_{aq} + mH_2O \leftrightarrow \leftrightarrow [(pPy^{n+})(Cl^-)_n (H_2O)_m]_{gel} + (n\ e^-)_{metal} \quad (1)$$

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Those materials with prevailing cation interchange, the film shrinks during oxidation and swells during reduction according with the reaction:

$$[(pPy^{0})[n(MA^-)n(C^+)]_{gel} \leftrightarrow \leftrightarrow [(pPy^{n+})(MA^-)_n]_s + n(C^+)_{aq} + (ne^-)_{metal} \quad (2)$$

Where s means solid and aq, aqueous solution, MA- represents any charge balancing macro-anion trapped inside the CP during polymerization, pPy represent the polypyrrole (or any other CP) chains and C^+ represent a cation.

Accepting as initial hypothesis that both, linear and bending movement of artificial muscles are originated by the driving electrochemical reaction, very single equations derived from the Faraday laws are expected to describe and quantify the movements.

In this work we will characterize the angular movement generated on bilayers constituted by polypyrrole-DBS-ClO_4^-/tape in aqueous solutions of $LiClO_4$ by flow of anodic and cathodic currents.

Experimental

Chemicals

Pyrrole (Fluka) was purified by distillation under vacuum using a diaphragm vacuum pump MZ 2C SCHOTT and stored under nitrogen atmosphere at -10ºC. Anhydrous lithium perchlorate salt (Fluka) and dodecylbenzenesulfonic acid solution (70 wt % in 2-propanol) (DBSA) (Aldrich) were used as received. Ultrapure water from Millipore Milli-Q equipment was used.

Film preparation

Polypyrrole films were prepared at room temperature (20 ± 2ºC) in dark conditions in a one-compartment electrochemical cell from 0.1M $LiClO_4$, 0.1M DBSA and 0.1M pyrrole aqueous