

DIPARTIMENTO DI CHIMICA, MATERIALI E INGEGNERIA CHIMICA GIULIO NATTA

HAVE FUN WITH SMART INTERACTIVE MATERIALS AND NANOSTRUCTURES

Sezione Scienza e Ingegneria dei Materiali

Chiara Bertarelli



THE ORIGIN



"Luce e materia: collaborazione essenziale" Piccolo Teatro di Milano 2013

Would you like to join my research group? (Prof. G. Zerbi, 1998)







THE FUNDAMENTAL ROLE OF THE STRUCTURE TO PROPERTY RELATIONSHIP



HAVE FuN with PHOTOCHROMISM

PHOTOCHROMIC GLASSES



colorless form

coloured photomerocyanine

New

Transitions Signature GEN8

Protect Your Eyes In Style



5,543.8 MLN USD

8,591.3 MLN USD

2020

Expected 2026













by M. Irie



SMART MATERIALS MEETS ASTRONOMY





Osservatorio Astronomico di Brera Osservatorio Astronomico di Padova





SMART MATERIALS MEETS ASTRONOMY





Laser printed FPMs







- LASER CUT
- DISPOSABLE
- CONTRAST >100
- NOT VERSATILE

SMART MATERIALS MEETS ASTRONOMY

Scientific case: detection of H $\!\alpha$ line (656.28 nm)







Laser printed FPMs











Sky object: nebula



3

6

9

Spectra obtained after the reduction process







CHANGES OTHER THAN COLOUR: AN EXAMPLE

Coupling conductive carbon nanotubes with a photochromic polyester allows for tuning the conductive properties by photoswitching



Light-triggered conductive properties

hotochromic polymer film





J. Phys. Chem. C, 116, 19483-19489 (2012)

0 0

0 0

UV



A NEW FRONTIER FOR PHOTOCHROMISM: CELL STIMULATION AND PHOTOTHERAPY





ISTITUTO ITALIANO DI TECNOLOGIA



MATERIAL DESIGN

ZIAPIN 2





Neuronal firing modulation by a membran targeted photoswitch Mattia Lorenzo DiFrancesco o 1213, Francesco Lodola 333, Elisabetta Colombol 233, Luca Mattia Lorenzo DiFrancesco Maria, Francesco Logola Maria, Elisabetta Colorido Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Mauro Dalla Serra Control Maria Paterno 2, Pietro Baldelli²⁴, Pietro Baldel Mattia Bramini © 1640, Giuseppe Maria Paterno © 7, Pietro Baldelli M. Mauro Dalla Serra Lorenzo Lunelli 56, Marta Marchioretto 56, Giorgio Grasselli © 12, Simone Cimò © 37, Letizia Dominio Ennelli E Entre Ontion® Vito Vitrena Cimil Gilos Elofthorio 12, Il Domitro Choralda 2 Lorenzo Luneur, Marta Marchioretto", Giorgio Grassemer, Simone Cimova, Letizia Daniele Fazzi⁸, Fausto Ortica⁹, Vito Vurro³, Cyril Giles Eleftheriou^{12,21}, Dmytro Shmal ^{12,2} Lorenzo A Anno Marta Matanaguratizata Chiana Doctoord^{112,213}, Circlindon Langard State and Daniele Fazzı", Fausto Ortica", Vito Vurro", Cyril Giles Eleftheriou^{1,6,0}, Dmytro Shmal ^{10,1} José Fernando Maya-Vetencourt^{1,2,12}, Chiara Bertarell^{1,3,2,3}, Guglielmo Lanzani ^{0,3,10}, and ^{10,1}, ¹⁰ Optical technologies allowing modulation of neuronal activity at high spatio-temporal resolution are been neuroscience. In this respect, azobenzene-based photoswitches are promising nanoscale isolation are been allowed by a delayed depolarization in the dark, resulting in an increased membrane capacitation in the treggers action potential firing. These effects are persistent and capacity of the second states of the second states are in the second states of the second states are persistent and capacity of the second states the second states of the se demonstrated that in neurons loaded with the compound, millisecond pulses of visible light induce a transient by ton followed by a delayed depolarization that triggers action potential firing. These effects are persistent and can be invited of 7 days, proving the potential of 2 lapin2 for the modulation of membrane capacitance in the millisecond without directly affecting ion channels or local temperature. 168 200 0624 48 Time (h)

nature nanotechnology

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EU-H2020



NANOACTUATORS FOR CELL STIMULATION:

Long-term stability

Enhanced firing

Specificity towards cell types, or organelles

Study of bacterial activity



ORGANIC THERMOELECTRICS

Tailored dopants for high conductivity of n-type polymers





C. Castiglioni, M. Tommasini, A. Famulari

MIX AND MATCH with nanofibers







M. Tommasini







chiara.bertarelli@polimi.it