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Conferencia:

Epitaxial crystals of $Bi_2Pt_2O_7$ pyrochlore through the transformation of δ–Bi_2O_3 fluorite

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Universidad Rey Juan Carlos - Madrid

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Aula de Seminarios do CIQUS

12:15 h

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Epitaxial crystals of $Bi_2Pt_2O_7$ pyrochlore through the transformation of δ–Bi_2O_3 fluorite

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Pyrochlore oxides, $A_2B_2O_7$, that exhibit catalytic activity toward oxygen reduction and mixed ionic-electronic conduction are prospective cathode materials for various types of fuel cells. Specifically, pyrochlore powders have been studied as cathode materials in solid oxide fuel cells. However, epitaxial oxide thin films can have superior properties compared to powders. On the other hand, there is an increasing interest in epitaxial films of materials with crystal structures different from perovskite, such as pyrochlore, not yet studied in epitaxial form for fuel cell applications.

$Bi_2Pt_2O_7$ pyrochlore is thought to be one of the most promising oxide catalysts for application in fuel cell technology. Unfortunately, direct film growth of $Bi_2Pt_2O_7$ has not yet been achieved, owing to the difficulty of oxidizing platinum metal in the precursor material to Pt^{4+}. In this work, in order to induce oxidation of the platinum, we annealed pulsed laser deposited films consisting of epitaxial δ–Bi_2O_3 and co-deposited, comparatively disordered platinum. We present synchrotron x-ray diffraction results that show the non-uniform annealed films contain the first epitaxial crystals of $Bi_2Pt_2O_7$. We also visualized the pyrochlore structure by scanning transmission electron microscopy. The similarity between the δ–Bi_2O_3 and $Bi_2Pt_2O_7$ structures appears to facilitate the pyrochlore formation. These results provide the only route to date for the formation of epitaxial $Bi_2Pt_2O_7$.

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Tenured Lecturer, permanent position (Profesor Contratado Doctor) at Universidad Rey Juan Carlos (Madrid, Spain)
National accreditation for Associate Professor by Spanish National Agency for Quality Assessment and Accreditation
Positive assessment of three six-year periods of research activity by Spanish National Commission of Assessment of Research Activity

EDUCATION

1994	Degree in Physics (5 years), Universidad Autónoma de Madrid (Spain)
1999	PhD in Physics, Universidad Autónoma de Madrid (Spain)
2001	Degree in Psychology (5 years), Universidad Autónoma de Madrid (Spain)

COMPETITIVE SCHOLARSHIPS, RESEARCH GRANTS

2014	Research grant awarded by Cornell University (NY, USA), 1 month
2013	Research grant awarded by Energy Materials Center at Cornell (emc2), Cornell University (NY, USA), 2 months
2013	Mobility grant awarded by the Government of Spain. Host institution: Cornell University (NY, USA), 5 months
2012	Mobility grant awarded by CajaMadrid Foundation (Spain). Host institution: Cornell University (NY, USA), 6 months
2006 – 2009	Ramón y Cajal Research contract, awarded by the Ministry of Science and Innovation (Spain). Host institution: Universidad Rey Juan Carlos (Madrid, Spain)
2001 - 2003	Marie Curie Individual Postdoctoral Fellowship, awarded by the European Union. Host institution: Université de Paris 6 (Pierre et Marie Curie), Groupe de Physique des Solides, CNRS (currently, Institut des Nanosciences de Paris)
1998	Mobility grant awarded by the Government of Madrid (Spain). Host institution: Université Pierre et Marie Curie, (Paris, France), 3 months
1997	Mobility grant awarded by the Government of Madrid (Spain). Host institution: Université Pierre et Marie Curie, (Paris, France), 3 months
1995 - 1999	Predoctoral Research Fellowship, awarded by the Government of Madrid (Spain)

LANGUAGE COMPETENCIES

Spanish: mother tongue
English: C2 level – Proficient user
Certificate in Advanced English (CAE), University of Cambridge, 2013
C2 level at British Council (Madrid), 2015
French: C2 level – Proficient user
DALF C2 (Diplôme Approfondi de Langue Française), Ministère de l'Éducation Nationale, France, 2003

RESEARCH INTERESTS

Thin film growth of complex oxides by Pulsed Laser Deposition
Structure-property relationships of functional complex oxides. Among them, materials with strong spin-orbit coupling interaction and pyrochlore oxides

SELECTED PUBLICATIONS

Epitaxial crystals of $Bi_2Pt_2O_7$ pyrochlore through the transformation of δ–Bi_2O_3 fluorite
A. Gutiérrez–Llorente, H. Joress, A. Woll, M. E. Holtz, M J. Ward, M. C. Sullivan, D. A. Muller, and J. D. Brock
APL Materials 3, 036105 (2015)

Research highlighted by the American Institute of Physics (AIP):
http://www.aip.org/publishing/journal-highlights/researchers-synthesize-new-thin-film-material-use-fuel-cells

Complex oxide growth using simultaneous in situ reflection high-energy electron diffraction and x-ray reflectivity: When is one layer complete?
M. C. Sullivan, M. J. Ward, A. Gutiérrez-Llorente, E. R. Adler, H. Joress, A. Woll and J. D. Brock
Applied Physics Letters 106, 031604 (2015)

Deep-red excimer emission from Ir doped organic light-emitting devices
A. Gutiérrez-Llorente, M.M. Mroz and J. Cabanillas-González.
Journal of Materials Chemistry C, 1(22), 3606-3615 (2013)

Energy Transfer within Mixed Phase Polyfluorene Based Phosphorescent Electroluminescent Devices
A. Gutiérrez-Llorente, B. Arredondo, B. Romero.
Journal of Physical Chemistry C 116(6), 4259-4266 (2012)

Thin films of oxygen-deficient perovskite phases by pulsed-laser ablation of strontium titanate
R. Perez-Casero, J. Perrière, A. Gutiérrez-Llorente, D. Defourneau, E. Millon, W. Seiler, and L. Soriano.
Physical Review B 75 165317 (2007)

Er-doped Zn-O thin films grown by pulsed-laser deposition
R. Pérez-Casero, A. Gutiérrez-Llorente, O. Pons-y-Moll, W. Seiler, R.M Defourneau, D. Defourneau,, E. Millon, J. Perrière, P. Goldner, B. Viana.
Journal of Applied Physics 97(5), 054905 (2005)

Growth of polyalkylthiophene films by matrix assisted pulsed laser evaporation
A. Gutiérrez-Llorente, G. Horowitz, R. Pérez-Casero, J. Perrière, J.L Fave, A. Yassar, C. Sant.
Organic Electronics 5 (2004)

Growth of anthracene thin films by matrix-assisted pulsed laser evaporation
A. Gutiérrez-Llorente, R. Pérez-Casero, B. Pajot, J. Roussel, R.M Defourneau, D. Defourneau, J.L Fave, E. Millon, J. Perrière.
Applied Physics A 77 (2003)

Epitaxial growth of Pt and oxide multilayers on MgO by laser ablation
M. Morcrette, A.Gutiérrez-Llorente, W. Seiler, J. Perrière, A. Laurent, P. Barboux.
Journal of Applied Physics 88(9) (2000)

Growth by laser ablation of Ti-based oxide films with different valency states
M. Morcrette, A. Gutiérrez-Llorente, A. Laurent, J. Perrière, P. Barboux, J.P Boillot, O. Raymond, T. Brousse. Applied Physics A-Materials Science & Processing 67, 425-428 (1998)