Angel Yanguas-Gil

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EXPERIENCE

July 2009 - Present Assistant Materials Scientist, Process Technology, Energy Systems, Argonne National Laboratory.

- Growth of oxide and semiconductor thin films using Atomic Layer Deposition.
- Development of nanostructured dye-sensitized solar cells. Synthesis of aerogel and xerogel thin films.

April 2007 - July 2009 Postdoctoral Research Associate, Materials Science and Engineering Dep., University of Illinois at Urbana-Champaign, Urbana (IL). P. I.: Prof. J. R. Abelson.

- Conformality and nucleation enhancement in chemistry based vapor deposition techniques. Influence of surface kinetics on conformality, nucleation and microstructure in low pressure CVD.
- Growth and characterization of metal oxide and doped metal oxide thin films using novel CVD precursors based on the N,N-dimethyldiboranamide ligand.
- Growth and characterization of diffusion barriers and hard protective coatings grown by low pressure CVD based on metal diborides (Intel research projects).

Dec. 2005 - Jan. 2007 Research Scientist, Fakultät für Physik und Astronomie, Ruhr Universität, Bochum (Germany). P. I.: Prof. A. von Keudell. Contract funded by European Union research project BIODECON (5th Framework Program).

- Thin film growth and plasma chemistry in Ar/C_2H_2 and Ar/CH_4 atmospheric pressure microplasmas. Electrical and optical characterization of atmospheric pressure microdischarges.
- Development of a computer interface for the automatic operation of low pressure plasma reactors for biodecontamination applications. (BIODECON European Union research project).

Sep. 2001 - Dec. 2005 Graduate Research Associate, Materials Science Institute, Spanish National Research Council (CSIC), Sevilla (Spain). P. I.: Prof. A. R. González-Elipe and Prof. J. Cotrino.

- Microstructure evolution, kinetic roughening and plasma chemistry in low pressure PECVD of $SiO_xC_yH_z$ and SiO_2 thin films.
- Kinetic models of plasma chemistry in high frequency nonthermal plasmas for CVD.

Sep. 2000 - Sep. 2001 Undergraduate Researcher, Physics Department, University of Sevilla, Sevilla (Spain). P. I.: Prof. J. Cotrino.

- Monte Carlo simulation of low pressure, high frequency Ar plasmas.

Other research experience

May 2005 - July 2005 Visiting Scholar. Chemistry Department, Cambridge University, Cambridge (UK). P. I.: Prof. R. M. Lambert. AFM study of kinetic roughening in low pressure PECVD. UPS and XPS studies of $Cu/SiO_xC_yH_z$ interfaces.

Nov 2004, March 2005 Visiting researcher. EMPA research center, Thun (Switzerland). P. I.: Prof. P. A. Groening. Plasma characterization of $Ar/Si(CH_3)_4/O_2$ mixtures.

July 2003, Dec. 2004 Visiting scholar. Centro de Fisica de Plasmas, Instituto Superior Tecnico, Lisboa (Portugal). P. I.: Prof. L. L. Alves. Theoretical models of low pressure Ar surface-wave plasmas.

EDUCATION

PhD in Physics Spanish National Research Council (CSIC) - University of Sevilla, Sevilla, Spain (2006). PhD Thesis: Study of the Plasma Enhanced Chemical Vapor Deposition of SiO_2 and $SiO_xC_yH_z$ Thin Films.

MS in Physics University of Sevilla, Sevilla, Spain (2004). MS Thesis: Kinetic Models of High Frequency, Low Pressure Ar Plasmas.

BS in Physics University of Sevilla, Sevilla, Spain (2001).

PUBLICATIONS

1. N. Kumar, A. Yanguas-Gil, S. R. Daly, G. S. Girolami and J. R. Abelson, *Remote plasma treatment of surfaces: enhanced nucleation in low-temperature chemical vapor deposition.* Appl. Phys. Lett. 95, 144107 (2009).

2. A. Yanguas-Gil, N. Kumar, Y. Yang and J. R. Abelson, *Highly conformal film growth by chemical vapor deposition. II. Conformality enhancement through growth inhibition.* J. Vac. Sci. Technol. A 27, 1244 (2009).

3. A. Yanguas-Gil, N. Kumar, Y. Yang and J. R. Abelson, *Highly conformal film growth by chemical vapor deposition. I. A zone diagram based on kinetics.* J. Vac. Sci. Technol. A 27, 1235 (2009).

4. N. Kumar, A. Yanguas-Gil, S. R. Daly, G. S. Girolami and J. R. Abelson, *Growth inhibition to enhance conformal coverage in thin film chemical vapor deposition*, J. Am. Chem. Soc. **130**, 17660 (2008).

5. M. Schulze, A. Yanguas-Gil, A. von Keudell and P. Awakowicz, *A robust method to calculate metastable and resonant state densities from emission spectra in argon plasmas.* J. Phys. D, Appl. Phys. **41**, 065206 (2008).

6. A. Borras, A. Yanguas-Gil, A. Barranco, J. Cotrino and A. R. Gonzalez-Elipe, *Relationship between scaling behavior and porosity of plasma-deposited TiO_2 thin films.* Phys. Rev. B **76**, 235303 (2007).

7. A. Yanguas-Gil, J. Cotrino, A. Walkiewicz-Pietrzykowska and A. R. Gonzalez-Elipe, *Scaling behavior and mechanism of formation of SiO_2 thin films grown by Plasma Enhanced Chemical Vapor Deposition.* Phys. Rev. B **76**, 075314 (2007).

8. J. Benedikt, V. Raballand, A. Yanguas-Gil, K. Focke and A. von Keudell, *Thin film deposition by means of atmospheric pressure microplasma jet.* Plasma Phys. Contr. Fusion **49**, B419 (2007).

9. A. Yanguas-Gil, K. Focke, J. Benedikt and A. von Keudell, *Optical and electrical characterization of an atmospheric pressure microplasma jet for Ar/CH_4 and Ar/C_2H_2 mixtures.* J. Appl. Phys. **101**, 103307 (2007).

10. A Barranco, F. Aparicio, A. Yanguas-Gil, P. Groening, J. Cotrino and A. R. Gonzalez-Elipe, *Optically active thin films deposited by plasma polymerization of dye molecules.* Chemical Vapor Deposition **13**, 319 (2007).

11. A. Yanguas-Gil, J. Cotrino and A. R. Gonzalez-Elipe, *Global model of a low pressure ECR microwave plasma applied to the PECVD of SiO_2 thin films.* J. Phys. D: Appl. Phys. **40**, 3411 (2007).

12. D. Dudeck, A. Yanguas-Gil, F. Yubero, J. Cotrino, J. P. Espinos, W. de la Cruz and A. R. Gonzalez-Elipe, *First nucleation steps during deposition of SiO_2 thin films by plasma enhanced chemical vapor deposition.* Surf. Sci. **601**, 2223 (2007).

13. J. Chaboy, A. Barranco, A. Yanguas-Gil, F. Yubero and A. R. Gonzalez-Elipe, *Si K edge XANES study of $SiO_xC_yH_z$ amorphous polymeric materials.* Phys. Rev. B **75**, 075205 (2007).

14. A. von Keudell, I. Kim, A. Consoli, M. Schulze, A. Yanguas-Gil and J. Benedikt, *The search for growth precursors in reactive plasmas: from nanoparticles to microplasmas.* Plasma Sources Sci. Technol. **16**, S94 (2007).

15. A. Yanguas-Gil, A. Barranco, J. Cotrino, P. Groening and A. R. Gonzalez-Elipe, *Plasma characterization of oxygen-tetramethylsilane mixtures for the plasma-enhanced CVD of $SiO_xC_yH_z$ thin films.* Chemical Vapor Deposition **12**, 728-735 (2006).

16. J. Benedikt, K. Focke, A. Yanguas-Gil and A. von Keudell, *Atmospheric pressure microplasma jet as a depositing tool.* Appl. Phys. Lett. **89**, 251504 (2006).

17. A. Yanguas-Gil, J. Cotrino, A. Barranco and A. R. Gonzalez-Elipe, *Influence of the angular distribution function of incident particles on the microstructure and anomalous scaling behavior of thin films.* Phys. Rev. Lett. **96**, 236101 (2006).

18. A. Barranco, A. Yanguas-Gil, F. Yubero and A. R. Gonzalez-Elipe, *Analysis of $SiO_xC_yH_z$ polymeric materials by x-ray absorption spectroscopy: Anomalous behavior of the resonant SiKLL Auger spectra.* J. Appl. Phys. **100**, 033706 (2006).

19. A. Yanguas-Gil, J. Cotrino and A. R. Gonzalez-Elipe, *Measuring the electron temperature by optical emission spectroscopy in two temperature plasmas at atmospheric pressure: A critical approach.* J. Appl. Phys. **99**, 033104 (2006).

20. A. Yanguas-Gil, J. Cotrino and A. R. Gonzalez-Elipe, *Influence of the excited states on the electron-energy distribution function in low-pressure microwave argon plasmas.* Phys. Rev. E **72**, 016401 (2005).

21. A. Yanguas-Gil, J. Cotrino, F. Yubero and A. R. Gonzalez-Elipe, *Growth mechanisms of SiO_2 thin films prepared by plasma enhanced chemical vapour deposition.* Surf. Coatings Technol. **200**, 881 (2005).

22. A. Yanguas-Gil, J. Cotrino and L. L. Alves, *An update of argon inelastic cross sections for plasma discharges.* J. Phys. D: Appl. Phys. **38**, 1588 (2005).

23. A. Yanguas-Gil, J. Cotrino and A. R. Gonzalez-Elipe, *Collisional radiative model of an argon atmospheric capillary surface-wave discharge.* Phys. Plasmas **11**, 5497 (2004).

24. A. Yanguas-Gil, J. L. Hueso, J. Cotrino, A. Caballero and A. R. Gonzalez-Elipe, *Reforming of ethanol in a microwave surface-wave plasma discharge.* Appl. Phys. Lett. **85**, 4004 (2004).

PATENTS

- N. Kumar, A. Yanguas-Gil, G. S. Girolami and J. R. Abelson, *Surface preparation for thin film growth by enhancing nucleation* , US Patent Pending.

AWARDS

MEC Postdoctoral Fellow (2007), Fundación la Caixa Postdoctoral Fellow (2006), MEC Predoctoral Fellow (2004), CSIC I3P Predoctoral Fellow (2001), MEC Fellowship for Undergraduate Research (2000).

OTHER

Technical skills: Vacuum technology, thin film growth, low pressure and atmospheric pressure plasma engineering (RF, MW and DC), surface characterization techniques, data adquisition systems.

Thin film growth techniques: CVD, PECVD, ALD, Sputtering, Evaporation and Anodizing.

Materials and plasma characterization techniques: SEM, AFM, XPS, UPS, Auger, RBS, XRD, FTIR, TEM, XANES/EXAFS, Ellipsometry, UV/Vis, Bias Temperature Stress measurements. Mass Spectrometry, Optical Emission Spectroscopy, VI and probe measurements.

Synchrotron experience: LURE (Orsay, France), BESSYII (Berlin, Germany).

Programming and computer skills: Programming languages: Python, C, Fortran, Labview, C++, HTML and LaTeX. Rudiments of Java and Javascript. Operative systems: Windows, Mac OS, Unix and Linux (Gentoo, Debian and Ubuntu).

Referee of the following journals: Chem. Vap. Dep., Surf. Coatings Technol., New J. Phys., J. Phys. D: Appl. Phys., J. Phys. A: Math. Theor., Physica A, Spectrosc. Lett.

Languages: Spanish, English (proficient), French, German and Japanese.

Teaching experience: AFM training lessons in postgraduate course: Introduction to experimental techniques in materials science, Spanish National Research Council (CSIC), 2004.

Affiliations: American Physical Society (Prairie section, Forum on the history of physics, Forum on industrial and applied physics), American Association for the Advancement of Science, Materials Research Society, American Vacuum Society.

Community service: Organization of the ICMSE-CSIC exhibitor in the Sevilla Science Fair 2003 and 2004, Reviewer of the American Library Association journal CHOICE.

Other interests: Development of scientific applications for data treatment in Python; history of mathematics, science and technology.