Pylin Sarobol

U.S. Citizen

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EDUCATION

Purdue University, IN
Doctor of Philosophy in Materials Engineering May, 2013
Ph. D. Thesis: Effects of Local Film Properties on the Nucleation and Growth of Tin Whiskers and Hillocks GPA: 4.0/4.0

Iowa State University, IA
B.S. in Materials Engineering May, 2008
Specialization in the field of electronic materials and metallurgy GPA: 3.94/4.0

PROFESSIONAL EXPERIENCE

Purdue University, West Lafayette, IN
Graduate Researcher 2008-2013
Growth Mechanisms of Whiskers and Hillocks on Pb-Free Sn-Alloyed and SAC305 Solder Films
Collaborated with Carnegie Mellon University on

- "Effect of Thermoelasticity on the Formation of Tin Whiskers and Hillocks on Sn-Alloyed Films"
  - Determined the mechanical response of the Sn-alloyed films due to a change in temperature. Correlated findings from synchrotron micro-diffraction measurements to those from simulation, utilizing thermoelastic fast fourier transform (FFT) method.

Collaborated with Cisco Systems, Inc. on

- "Effect of Thermal Cycling on the Propensity to Form Whisker on Sn-Alloyed and SAC305 Solder Films"
  - Determined the relationship between film properties (electrolyte composition, grain size and as-plated/reflowed condition) and the propensity to form whiskers of a particular film as a function of thermal/humidity hold and thermal cycling according to JEDEC testing.
- "Whisker Nucleation on Electroplated Sn-Cu Films and SAC305 Solder Films"
  - Designed and performed experiments to test hypothesis and examine Sn whisker nucleation at the predicted locations on the samples.
- "Whisker Growth on Differently Textured, Electroplated Sn-Alloyed Films"
  - Designed and performed experiments that captured Sn whisker and hillock morphology as a function of texture by varying electroplating parameters and conditions.

Collaborated with Foresite, Inc. on

- "Effect of Surface Contamination on Whisker Growth in Pb-Free Electroplated Films"
  - Fabricated samples and performed analysis to correlate the propensity to form whiskers of a film as a function of contaminant types and quantities.

Teaching Assistant 2008 and 2011

- Graded homework, quizzes and exams. Evaluate student performance according to ABET criteria.
- Held office hours for an Atomistic Materials Science, MSE270, class of 40 students (2011) and led two recitations for a Structure and Properties of Materials, MSE230, class of 60 students total (2008).

PROFESSIONAL EXPERIENCE (Continued)

Iowa State University, Ames, IA
Teaching Assistant 2008

- Graded homework and held office hours for a Nondestructive Evaluation, MatE362, class of 36 students.

Undergraduate Researcher 2005-2007

- "Effects of solidification velocity on flake-to-fiber transition of Al-Si eutectic cast alloy microstructures."
  - Characterized particle morphology and spacing from micrographs.
- "Influence of 5% La and Sc doping on electrical properties in $Pb(Mg_{1/3}Nb_{2/3})O_3$-based ferroelectric ceramics."
  - Calculated compositions, processed, tested ceramics specimen, and improved functions of LabView program, which was used in collecting dielectric characterization measurements.

Caterpillar, Inc., Mossville, IL
Heat-Treat Engineering Corporate Summer Intern 2007

- Performed and developed standard procedures for Shim stock and gas analysis to reduce reject parts in crankshaft heat-treating line as well as ultrasonic testing of field-returned diesel particulate filters.
- Determined causes for failed heat-treated liner audits and improved data recording in the liner line.

PUBLICATIONS

- **P. Sarobol**, J.P. Koppes, W.H. Chen, P. Su, J.E. Blendell and C.A. Handwerker, "Recrystallization as a Nucleation Mechanism for Whiskers and Hillocks on Thermally Cycled Sn-Alloy Solder Films," *Materials Letters*, vol. 99, pp. 76-80, 2013.

- **P. Sarobol**, J.E. Blendell and C.A. Handwerker, "Whisker and hillock growth via coupled localized Coble creep, grain boundary sliding, and shear induced grain boundary migration," *Acta Materialia*, vol. 61, pp. 1991-2003, 2013.

- **P. Sarobol**, W.H. Chen, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker, "Effects of Local Grain Misorientation and β-Sn Elastic Anisotropy on Whisker and Hillock Formation," Journal of Materials Research, vol. 28, pp. 747-756, 2013.

- **P. Sarobol**, A.E. Pedigo, P. Su, L. Li, J. Xue, C.A. Handwerker, and J.E. Blendell, "A Synchrotron Micro-Diffraction Investigation of Crystallographic Texture of High-Sn Alloy Films and Its Effects on Whisker Growth," *proceeding of the 60th Electronic Components and Technology Conference*, June, 2010. p. 162-169.

- **P. Sarobol**, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker, "Changes in Defect Morphology and Texture in Sn-Cu and Sn-Cu-Pb Electroplated Films," *IEEE Transactions on Electronics Packaging Manufacturing*, Vol. 33, No. 3, July, 2010 p. 159-164.

- A.E. Pedigo, **P. Sarobol**, P. Su, C.A. Handwerker, and J.E. Blendell, "Crystallographic Texture of Sn-based Electroplated Films," *proceeding of the 42nd International Symposium on Microelectronics*, IMAPS International Microelectronics and Packaging Society, 2009.

HONORS

- **National Science Foundation Graduate Research Fellow** 2010-present
- **Bill and Melinda Gates Millennium Scholarship Recipient** 2004-present
- **Purdue University College of Engineering Outstanding Graduate Student Research Award** 2013
- **Selected member of the School of Materials Engineering Head Search Committee** 2011-12
- Awarded third place in IPC APEX EXPO Academic Poster Competition 2011
- SMTA Charles Hutchins Educational Grant Award 2011
- Awarded first and second place in IPC APEX EXPO Academic Poster Competition 2010
- Purdue University College of Engineering Magoon Award for Outstanding Teaching Assistant 2009
- **Purdue University Graduate Student Award for Outstanding Teaching** 2009
- Awarded third place in IPC APEX EXPO Academic Poster Competition 2009
- Iowa State University Fehr-Mcgee Scholarship Recipient 2005-2008
- Iowa State University Multicultural Vision Program Scholarship Recipient 2004-2008

CONFERENCE PRESENTATIONS AND POSTERS

(A complete list of conference presentations and posters available upon request)

- **P. Sarobol**, J.E. Blendell and C.A. Handwerker. *Tin Whisker and Hillock Growth Mechanism Via Grain Boundary Sliding Coupled with Shear Induced Grain Boundary Migration*, Contributed oral Presentation. TMS, San Antonio, TX. March 3-7, 2013.
- **P. Sarobol**, J.P. Koppes, W.H. Chen, P. Su, J.E. Blendell and C.A. Handwerker. *Recrystallization as a Nucleation Mechanism for Whiskers and Hillocks on Thermally Cycled Sn-Alloy Solder Films*, Contributed Poster Presentation. TMS, San Antonio, TX. March 3-7, 2013.
- **P. Sarobol**, W.H. Chen, Y. Wang, J.P. Koppes, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker, *Tin Whisker Formation: A Predictive Model Based on Local Microstructure/Grain Boundary Properties,* Contributed oral presentation. Tin Whisker Telecon, January 30, 2013.
- **P. Sarobol**, W.H. Chen, Y. Wang, J.P. Koppes, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker. *Tin Whisker Formation: A Predictive Model Based on Local Microstructure/Grain Boundary Properties,* **Invited** oral presentation. The Fifteenth Pb-Free Electronics Risk Management (PERM) Consortium, Salt Lake City, UT. February 4-7, 2013.
- **P. Sarobol**, J.E. Blendell and C.A. Handwerker. *Tin Whisker and Hillock Growth Mechanism Via Grain Boundary Sliding Coupled with Shear Induced Grain Boundary Migration,* **Invited** oral presentation. The Fifth International Symposium on Tin Whiskers, Loughborough University, Loughborough, England. November 27-28, 2012.
- **P. Sarobol**, J.E. Blendell and C.A. Handwerker. *Tin Whisker and Hillock Formation in Thin Films: Physics-Based Model for Growth and Site Selectivity,* **Invited** oral presentation. Sandia National Laboratories Science and Engineering Expo, November 12-13, 2012.
- **P. Sarobol**, W.H. Chen, J. E. Blendell, P. Su and C.A. Handwerker, *Effects of Grain Misorientations and Strain Distribution n the Location of Whisker Formation on Electroplated Sn-Cu films*, Contributed oral presentation. The SMTA International Conference. Fort Worth, TX, October 16-20, 2011.
- **P. Sarobol**, W.H. Chen, J. E. Blendell, P. Su and C.A. Handwerker, *Effects of Grain Misorientations and Strain Distribution n the Location of Whisker Formation on Electroplated Sn-Cu films*, Contributed poster presentation. The Gordon Research Conference on Physical Metallurgy, Stonehill College, Easton, MA. July31-August 5, 2011.

CONFERENCE PRESENTATIONS AND POSTERS (continued)

- **P. Sarobol**, W.H. Chen, J.E. Blendell, C.A. Handwerker, and P. Su*, Effects of Grain Misorientations and Strain Distribution on the Location of Whisker Formation,* IPC-APEX EXPO **Invited** Academic Poster, Las Vegas, NV. April 12- 14, 2011.
- **P. Sarobol**, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker, *Effects of Misorientations on Hillock and Whisker Growth in Sn-Cu and Sn-Cu-Pb Films: Synchrotron Micro-Diffraction Investigation*, Contributed oral presentation. MS&T, Houston, TX. October 17-21, 2010.
- **P. Sarobol**, A.E. Pedigo, P. Su, L. Li, J. Xue, J.E. Blendell and C.A. Handwerker, *Effect on Whisker Growth of Crystallographic Texture in Sn, Sn-Cu and Sn-Cu-Pb Films: Synchrotron Micro-Diffraction Investigation,* Contributed oral presentation*.* 4th International Symposium on Tin Whiskers, University of Maryland, College Park, MD. June 23-24, 2010.
- **P. Sarobol**, A.E. Pedigo, P. Su, L. Li, J. Xue, J.E. Blendell and C.A. Handwerker, *A Synchrotron Micro-Diffraction Investigation of Crystallographic Texture of High-Sn Alloy Films and its Effects on Whisker Growth*, Contributed oral presentation. 60th Electronic Components and Technology Conference, Las Vegas, NV. Jun 1-4, 2010.
- **P. Sarobol**, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker*, A Defect Phase Diagram for Tin Whisker and Local Film Properties Near Whiskers,* IPC-APEX EXPO **Invited** Academic Poster, Las Vegas, NV April 5-9, 2010.
- **P. Sarobol**, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker, *Changes in Defect Morphology and Texture in Sn-Cu and Sn-Cu-Pb Electroplated Films*, Contributed oral presentation. MS&T, Pittsburgh, PA. October 25-29, 2009.
- **P. Sarobol**, A.E. Pedigo, P. Su, J.E. Blendell and C.A. Handwerker, *Changes in Defect Morphology and Texture in Sn-Cu and Sn-Cu-Pb Electroplated Films*, **Invited** oral presentation**.** The Third International Symposium on Tin Whiskers, Technical University of Denmark, Lyngby, Denmark. June 23-24, 2009.

LEADERSHIP AND MENTORING EXPERIENCE

- **Purdue University Mentor for Undergraduate Researchers** 2009-2012
  - Mentored John Holaday on obtaining crystallographic misorientation from grain orientation maps, utilizing MatLab program (2011-2012).
  - Mentored Athena Davros on obtaining a calibration curve for film thickness as a function of electroplating time and current density (2009-2010).

- **Purdue University Materials Science & Engineering Graduate Student Association** 2009-2012
  - Chair of Professional Development Committee (2011-2012)
  - Selected Member of Laboratory Safety Committee (2011-2012)
  - Chair of Recruitment Committee (2009-2011)
  - Graduate Student Committee and Secretary (2009-2010)

- **Purdue University Thai Student Association** 2008-2010
  - Graduate Coordinator (2009-2010)
  - Public Relation and Event Director (2008-2009)

- **Iowa State Thai Student Association** 2005-2008
  - Vice president (2007-2008)
  - Treasurer (2006-2007)
  - Event Director (2005-2007)

LEADERSHIP AND MENTORING EXPERIENCE (continued)

- **Iowa State University Multicultural Vision Program** 2006-2007
  - Seminar leader and peer mentor to engineering freshmen scholars of diverse background to promote retention of underrepresented students
  - Led two seminar classes (total of 30 students) to assist the transition to college.

VOLUNTEER EXPERIENCE

- **Project Interchange Outreach Program Student Volunteer** 2013
  - Develop the new Purdue-Colombia collaborative outreach activity "Project Interchange" with the Santo Domingo Savio library (and community) and the Universidad de Antioquia in Medellin with the aim to increase the knowledge of science in high school students around Medellin and to encourage them in university study in STEM disciplines.
  - Plan and develop a science kit that SDS high school students can use to demonstrate nanotechnology concepts at local schools. Train volunteers .
  - Prepare proposals to NSF and ONR for on-going support of the program.

- **Introduce a Girl to Engineering Day (Women in Engineering Program) Volunteer** 2013
  - Planned and facilitated educational activities in the area of Materials Science and Engineering for female high school students.

- **Nanodays at Purdue University Birck Nanotechnology Center Student Volunteer** 2012-2013
  - Facilitated educational activities about nano-scale science and engineering for K-12 students.

- **Summer Undergraduate Research Fellowship Student Volunteer** 2012
  - Evaluated poster presentations of the summer undergraduate research fellows.

- **Electroplating Demonstrator for First Year Engineering Students** 2008-2011
  - Demonstrated and facilitated electroplating lab in a first year engineering class.

TECHNICAL SKILLS

- **Scanning Electron Microscopy (SEM) with Energy Dispersive X-ray Spectroscopy (EDX), Electron Backscatter Diffraction (EBSD), and Focused Ion Beam (FIB)**
  - Provided consultation and perform alignment, calibration and EBSD work for various research.
- **Atomic Force Microscopy (AFM) with Thermal Tip**
  - Used AFM thermal tip to locally melt and form surface grains on electroplated SnCu films.
- **Synchrotron Micro-diffraction and Analysis** (Advanced Light Source beamline 12.3.2)
  - Wrote proposals and was awarded three grants.
  - Designed experimental studies utilizing high resolution (1μm beam size), high energy (24MkeV), polychromatic x-rays to obtain grain-by-grain orientation and measure strain distribution.
  - Performed micro-diffraction and data analysis for four sets of experiments
    - Misorientations between Sn whiskers/hillocks and other grains on electroplated SnCu films
    - Evolution of strain distribution during hillock growth on SnCu electroplated films
    - Evolution of strain distribution and subgrain formation, capturing Sn whisker nucleation at the grain boundaries of SAC305 solders on Cu lead frames before and after thermal cycling