News Release

Dr. Jennie Hwang to deliver two courses on "*Package/Board Integrity & Solder Joint Reliability*" on October 7th and "*Preventing Product Failure*" on October 8th at IMAPS 2020 International Symposium on Microelectronics,

Dr Jennie S. Hwang leverages decades of extensive real-world experiences and deep knowledge to deliver two Professional Development Courses – 1. "**Package/Board Integrity & Solder Joint Reliability" and 2.** "**Preventing Product Failure."**

Registration:
https://imaps.org/symposium_pdcs.php#a7
https://imaps.org/symposium_pdcs.php#b8
Info: bschieman@imaps.org

With the goal to produce reliable products while achieving high yield production, the course on "**Package/Board Integrity & Solder Joint Reliability"** provides a holistic overview of product reliability and of critical 'players' of the package/board level integrity and solder joint reliability, including the roles of materials, processes and testing/service conditions, as well as the crucial principles behind the product reliability. Recent developments related to lead-free package and board assembly, lead-free solder materials, PCB laminates and surface finishes in relation to manufacturability and reliability will be outlined. The likely solder joint failure modes (interfacial, near-interfacial, bulk, inter-phase, intra-phase, voids-induced, surface-crack and others) will be illustrated. Solder joint reliability fundamentals including fatigue and creep damage mechanisms via ductile, brittle, ductile-brittle fracture will be outlined. To withstand harsh environments, the strengthening metallurgy to further increase fatigue resistance and creep resistance and the power of metallurgy and its ability to anticipate the relative performance will be illustrated by examining the comparative performance in relation to metallurgical phases and microstructures of solder joints. Parameters for a working life-prediction model will be highlighted. A relative reliability ranking among commercially viable solder systems, the scientific, engineering and manufacturing reasons behind the ranking, and newer solder alloy developments and their impact on product performance and reliability will be summarized. The course emphasizes on practical, working knowledge, yet balanced and substantiated by science. Attendees are encouraged to bring their own selected systems for deliberation.

The course on "**Preventing Product Failure"** focuses on two of likely product failure processes that are induced or aggravated by time, temperature and/or stress ? intermetallic compounds and tin whisker. Intermetallic compounds (IMCs) play an increasingly critical role to the performance and reliability of solder interconnections in the chip level, package level and board level of lead-free electronics. Relevant and important aspects of intermetallic compounds (scientific fundamentals and practical application scenarios) will be discussed. The course also examines the presence and formation of IMCs before, during and after solder joint formation (in storage and service), and the IMCs at-interface and in-bulk (contributing from packages and board surface finish coating) in relation to product reliability. The difference between SnPb and Pb-free solder joint in terms of intermetallic compounds, which in turn is attributed to production-floor phenomena and the actual field failure, will be discussed. Concerns about tin

whisker have been intensifying recently, although the potential issues of tin whisker have been recognized for more than six decades in electronic, electrical and industrial applications. Metal 'whiskering' is an intricate, atomic level process. While understanding of tin whisker has advanced, yet the myth exists. This course offers a holistic coverage, from practical perspectives, of all important aspects of tin whisker with emphasis on mitigating the risk by considering the factors that affect tin whisker growth and examining the preventive and remedial solutions. The distinctions of tin whisker from metal dendrites, electro-migration, tin pest and other processes, as well as the practical tin whisker criteria for reliability implications in both SnPb and lead-free environments will be highlighted. From practical perspectives, tin whisker with emphasis on risk mitigation through understanding the factors that affect tin whisker growth and its preventive and remedial solutions will be outlined. Practical tin whisker criteria for reliability implications in the lead-free environment and the relative effectiveness and the order of priority in mitigating measures will be ranked. The short course emphasizes on practical, working knowledge, yet balanced and substantiated by science. Attendees are encouraged to bring their own selected systems for deliberation.

Course A7:
"Package/Board Integrity & Solder Joint Reliability"

Main Topics:

* Premise of reliability and product failure prevention;
* Product reliability - principles
* Product reliability ? solder joint, PCB board and package considerations;
* Solder joint thermo-mechanical behavior and degradation ? fatigue and creep interaction;
* Solder joint failures modes - interfacial, near-interfacial, bulk, inter-phase, intra-phase, voids-induced, surface-crack, and others;
* Solder joint failure mechanisms ? ductile, brittle, ductile-brittle transition fracture;
* Solder joint strengthening metallurgy - increased fatigue resistance and creep resistance;
* Distinctions and commonalties between Pb-free and SnPb solder joints;
* Solder joint performance in harsh environments;
* Thermal cycling conditions - effects on test results and test results interpretation;
* Testing solder joint reliability ? discriminating tests and discerning parameters;
* Life-prediction model vs. reliability;
* Summary - product reliability, principles, best practices.

Course B8:
Preventing Product Failure

Main topics:

* Role of intermetallic compounds vs. product reliability
* Intermetallic compounds ? definition, fundamentals, characteristics;
* Phase diagrams of Pb-free solders in contrast with SnPb;
* Intermetallic compounds in the intrinsic material- Pb-free vs. SnPb;
* IMCs formation and growth during production process and in product service life;
* Different types of intermetallic compounds ? effects on solder joint reliability;
* Intermetallic compounds - at-interface vs. in-bulk;
* IMCs - effects from substrate compositions (hybrid module thick film pads, PCB surface finish) + component surface coating;

* Tin whisker vs. tin pest vs. dendrites;
* Whisker-resistant vs. whisker-proof;
* Tin whisker ? definition, clarification, reference point;
* Tin whisker - physical phenomena, causes and factors;
* Tin whisker ? concerns, reliability implications, testing challenges;
* Tin whisker - mitigation remedies, relative effectiveness, plausible theory;
* Summary - product reliability, principles, best practices.

About the Speaker:

Dr. Hwang, a pioneer and long-standing leader in lead-free electronics, brings her 35+ years SMT manufacturing experience coupled with her sustained 25+ years lead-free R&D and hands-on production implementation to the courses. She has been a major contributor to the implementation of Surface Mount manufacturing since its inception through hands-on production and as an advisor to OEMs, EMS and U.S. Dept. of Defense. She has provided solutions to many challenging problems, ranging from production yield to field failure diagnosis to most challenging reliability issues. Her work covers both commercial and military applications.

Her long list of clients ranges from many Fortune 100 companies to private boutique manufacturers. Her recent assignment has led her client to achieve a higher than 99.9% production first-pass yield from below 50%. She has also solved the reportedly toughest reliability issues in high reliability products, as well as eliminated production defects for low-cost consumer products through process optimization and materials improvements.

Dr. Hwang's SMT manufacturing experiences and problem-solving track record culminate in the publication of the very first book on the subject of '*SMT Solder Paste – Technology and Application*", and the books entitled: "*Modern Solder Technology for Competitive Electronics Manufacturing*" and *"IC Ball Grid Array & Fine Pitch Peripheral Interconnections.*" Her sustained leadership in lead-free R&D and hands-on production implementation are reflected in her authoring the groundbreaking books on the subject of lead-free technology and manufacturing, respectively, entitled: "*Environment-Friendly Electronics—Lead Free Technology*" and "*Implementation of Lead-free electronics manufacturing".*

She holds patents and has 550+ publications to her credit, including the sole authorship of several internationally-used textbooks. Her books, columns, and publications have been widely cited worldwide. Dr. Hwang has been a frequent keynote/featured speaker at worldwide events (United States Patent and Trademark Office, Federal Women's Program, university commencement speech, numerous industry events). Over the years, she has lectured to hundreds of thousands of professionals and researchers in professional development courses. As a columnist for the SMT magazine for the last 30+ years, she addresses the current issues, providing solutions and worldviews.

Additionally, she has served on the Board of NYSE Fortune 500 companies and on various civic, government and university boards and committees, including U.S. Commerce Dept. - Export Council; U.S. Defense Dept. - Globalization Committee, Forecasting Future Disruptive Technologies Committee, U.S. Army Research Panel; and has chaired the National Laboratories Assessment Panel – NIST-EEEL and the Assessment Panel on U.S. Army Research Laboratory. She serves on the Board of Army Science and Technology, the Laboratory Assessment Board and the National Materials and Manufacturing Board and chairs the Army Research Laboratory Technical Assessment Board and chairs the Assessment Board of Army Engineering Centers. She is a reviewer of various government programs and is prolific writer and speaker on the topics of trade, business, education and social agenda.

Among her many awards and honors are citations of recognition and achievement by the U.S. Congress, Honorary Doctoral degree, induction into WITI International Hall of Fame, named "R&D Star-to-Watch" (*Industry Week)*; YWCA Women of Achievement Award; election to the National Academy of Engineering. She was featured as one of the ten luminaries in the inaugural volume: "*Road to Scientific Success - Inspiring Life Stories of Prominent Researchers*", published by World Scientific Publications.

Her formal education includes four academic degrees (Ph.D. M.S., M.S., B.S. in Materials Science and Engineering, Physical Chemistry, Liquid Crystals Science, Chemistry, respectively), Harvard

Business School Executive Program and Columbia University Business School Corporate Governance program. She has held various senior executive positions with Lockheed Martin Corp., Hanson PLC (SCM Corp,) Sherwin Williams Co, and CEO of International Electronic Materials Corp. She is currently a principal of H-Technologies Group, providing business, technology and manufacturing solutions. She is also an invited distinguished adj. Professor of Engineering School of Case Western Reserve University, and serves on the University's Board of Trustees.

She has established endowment funds at her alma maters, dedicating to interdisciplinary education and to acquiring global exposures. The Dr. Jennie S. Hwang YWCA award, now for 19 years running, is established in her honor, recognizing outstanding women students pursuing a STEM discipline.

Her books and publications are well received worldwide, which have been the widely adopted textbooks throughout the global industry over three decades.

- (ISBN-0-07-143048-2) "*Lead-free Implementation: A Guide to Manufacturing*" McGraw-Hill, New York, 2005;
- (ISBN: 9780901150400) "*Environment-Friendly Electronics—Lead Free Technology*", Electrochemical Publications, LTD, Great Britain, 2001;
- (ISBN-0-07-031749-3) "*Modern Solder Technology for Competitive Electronics Manufacturing*", McGraw-Hill, New York, 1996;
- (ISBN-0-90-115029-0*)"IC Ball Grid Array & Fine Pitch Peripheral Interconnections*", Electrochemical Publications, LTD, Great Britain, 1995;
- In Japanese, "*Solder Paste: Technology and Applications for Surface Mount, Hybrid Circuits, and IC Component Manufacturing*", Industrial Research, Japan 1990;
- (ISBN-0442-2075-49) "*Solder Paste: Technology and Applications for Surface Mount, Hybrid Circuits, and IC Component Manufacturing*", Van Norstrand Reinhold, New York, 1988, currently by Springer Science & Business Media, LLC.
  http://www.springer.com/us/book/9789401160520

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