

**Attend IEEE IRPS 2017 - Register at <http://irps.org/>**

For 54 years, IRPS has been the **premier conference** for engineers and scientists to present new and original work in the area of **microelectronics reliability**. Drawing participants from the United States, Europe, Asia, and all other parts of the world, **IRPS seeks to understand the reliability of semiconductor devices, integrated circuits, and microelectronic assemblies** through an improved understanding of both the physics of failure as well as the application environment. IRPS provides numerous opportunities for attendees to **increase their knowledge and understanding of all aspects of microelectronics reliability**. It is also an outstanding chance to meet and network with reliability colleagues from around the world.

The 2017 IRPS conference program include **19 tutorials, 17 invited talks, 82 platform presentations, and 81 posters**. The **keynote speakers** will be **NASA Astronaut Dr. Nancy Currie-Gregg** "*Reflections on the risk of human space exploration – lessons learned from past failures*" and **IBM Distinguished Engineer Mr. Ronald Newhart** "*System Level Reliability Challenges with Technology Scaling*".

### **5 Reasons to Attend:**

- 1.** Listen to new and original work in the area of microelectronics reliability;
- 2.** It is the only meeting which presents as much leading work in so many different areas of reliability of electronic devices;
- 3.** The conference is suited for a broad audience, from the reliability neophyte to the well-practiced engineer;
- 4.** There is no other place to have this type of exposure and training;
- 5.** Increase your networking with industry leaders and professionals

**IRPS is Co-Sponsored by IEEE EDS and Reliability Society**



**Reliability Society**



**April 2-6, 2017**  
**Hyatt Regency Monterey**  
**Resort and Spa, CA, USA**

# IRPS2017 Pre-Conference Highlights

**Wide bandgap (WBG) semiconductors sessions** will be well represented with three entire sessions devoted to the reliability of SiC and GaN-based devices. **In the SiC tracks, 4 key speakers** have been **invited** to discuss about the reliability of today SiC MOSFET technology. The two GaN will present new reliability insights, understanding and aspects of GaN-based devices in cascode-mode, power GaN-based transistors under high (reverse) voltage stress and critical issues in e-mode power devicee.

**Transistor and beyond CMOS** session will have two sessions. In the first session, papers covering different aspects of BTI, HCI and self-heat effects will be discussed. Some aspects of variability will also be covered. In the second session, papers will cover some of the physical mechanisms of reliability, degradation of III-V channel transistors and also some reliability aspects of novel channel materials.

**Memory reliability** sessions will also be showcased at IRPS, including process optimization for MRAM and for vertical NAND memories as well as system-level approaches for SSDs. The emerging memory field is also represented, with studies on RRAM variability and error recovery.

**Dielectric** session will show that the Weibull distribution is insufficient to represent the complexities of FinFET degradation with solid statistical and physical evidence. Also there will be the first reports probing the breakdown phenomenon in a few (2L/3L) layered fluorinated graphene (FG) stacks at sub-nanoscale resolution in ultra-high vacuum (UHV). Experimental evidence of stress induced degradation and breakdown (BD) at nanoscale, progressive shrinkage of bandgap and multimodal BD distributions will also be presented

**Metallization reliability** session will present the recent investigation of novel interconnects for continuous scaling, that include a) Cobalt or Ruthenium-filled interconnects, b) doped Graphene-Nanoribbon (GNR) interconnect, c) new low-resistivity ALD-W capping, and d) atomically thin diffusion barriers. Also, there will be reports covering the effects of self-heating on electromigration and stress-migration, as self-heating becomes a limiting factor for semiconductor reliability.

**Circuit Reliability/Aging** session includes innovative papers on a wide range of topics. A thermally aware aging sensor design implemented in a 20nm SoC illustrates the advantages of incorporating such sensors to bound FEOL aging without exceeding the power constraints. Further, a novel on-die wave-front generator circuit is used to generate realistic AC waveforms to stress transistors as they would be in actual high-speed I/O applications. Also, a Physically Unclonable Function (PUF) is demonstrated by taking advantage of the intrinsic randomness of gate oxide breakdown position as the entropy source.

**Product** session will cover the latest industry trends on qualification, advancing the discussion on how we'll ensure next generation technologies are comprehended at the product level. Platform and Poster presentations will span a variety of product segments, from Automotive to CPUs to FPGA and beyond.

**Packaging** sessions will reflect recent industry trends toward scaling through the **package in 2.5/3D designs**. Reliability results from new package architectures accomplished using new applications of build-up processes as well as through interposers will be presented. The comparative reliability impact of a TSV-middle process on front-end of line (FEOL) devices and back-end of line (BEOL) structures will be presented. TSV orientation relative to fin-FET device orientation was studied.

**Soft Errors** in advanced electronic devices will also be reported, in particular: i) new insight on back bias effect on SOI SRAMs soft error rate, ii) Pioneering results on Polonium-diffusion effect on alpha emission rate and related soft errors; iii) The re-emergence of thermal-neutron soft errors in 16-nm FinFETs and iv) Soft errors in 10-nm FinFETs. Furthermore an invited talk on autonomous driving, discussing the challenges of implementing a safe, secure, complex driver assistance system will complete the session.

**Photovoltaic** sessions will present innovative findings on reliability of organic and inorganic solar cells. Innovative modeling and characterization techniques for the polymeric solar cells, as new tools for comparing the reliability and performances of different materials, as well as a method for investigating the degradation mechanisms of organic solar cells will be discussed. The profound difference of behavior between forward and reverse bias stress on thin film silicon solar cells, showing a clear evidence of the range of wavelengths of the photons needed to assist the recovery effect under DC voltage stress will also be presented.

**Reliability Testing** session will focus on the test equipment and methods that are used to design and perform modern reliability tests. Platform presentations will include topics ranging from product level reliability test concerns, to novel circuit level test structures, and device level defect detection using ultra high speed measurement. The practical aspects of testing will be explored along with the underlying physics of reliability.

**Systems reliability** session will report on the reliability of wide variety of systems like mobile displays, space systems, ceramic capacitors based systems, counterfeit electronics and semiconductor systems. In addition, two approaches will be presented to gather and assimilate data to improve reliability of systems: i) one based on gathering telemetry data from the device in the field; ii) second approach is data-driven hybrid physics-based technique for reliability allocation in early product development stages.

**Other opportunities at the symposium include:**

**Tutorials** begin with one track covering “reliability fundamentals” in silicon: FEOL, BEOL, electro-migration, and chip-package interactions. The second track consists of wide bandgap (GaN), VLSI design methodology and verification, NAND flash memory, and failure analysis challenges with respect to reliability. The second day of tutorials consists of advanced topics in silicon, automotive-IOT, integrated/memories, and circuit & system reliability.

**Year in Review** Session (Monday April 3). These seminars provide a summary of the past year's most noteworthy research and development in the field of microelectronics reliability. The distinguished speakers cull information from the recent literature and product announcements and provide an expert's interpretation of the impact. The Year in Review session helps the attendees to stay current with the recent reliability literature.

**Evening Poster Session.** The poster session will provide an additional opportunity for authors to present their original research. The setting is informal and allows for easy discussion between authors and other attendees.

**Evening Session Workshops.** These workshops enhance the symposium by providing the attendees an opportunity to meet in informal groups to discuss key reliability physics topics with the guidance of experienced moderators. All conference attendees are invited to join discussions of one or more of six topic areas, including self-heating effects on transistor reliability, expectations of extrinsic reliability in high reliability vs. low cost markets, middle of line dielectric models, GaN reliability testing, solid state drive reliability, and consumer off the shelf components in high reliability systems. These workshops provide excellent networking opportunities, as well as a forum for lively debate on the best approaches to characterizing and controlling reliability.

**Vendor Exhibits.** Held in parallel with the technical sessions, the equipment demonstrations provide a forum for manufacturers of state-of-the-art laboratory equipment to present their products. Attendees are encouraged to visit the manufacturers' booths for information and demonstrations.

**IRPS Paper Awards.** IRPS bestows awards for Best Paper, Outstanding Paper, Best Poster and Best Student Talk. The Best Paper author is typically invited to present the paper at ESREF in October.