

ELECTRONICS ASSEMBLY AND PACKAGING FOR HIGH TEMPERATURES

PROFESSIONAL ADVANCEMENT SHORT COURSE

MONDAY – 5 NOVEMBER 2018 – LOS GATOS, CALIFORNIA

Development of semiconductor devices for extreme-temperature operation is advancing, especially aimed at power systems, for applications that include electric vehicles, aircraft, petroleum exploration and spacecraft. Semiconductor devices based on SiC, GaN and C (diamond) are now capable of operating at 300 to 500°C, and commercial availability is expanding, but their capability cannot be utilized unless assembly and packaging techniques keep pace.

Course Objectives: (a) Provide practical information on materials (metals, ceramics, plastics, etc.) and techniques (attachment, interconnecting, packaging, etc.) for high-temperature electronics. (b) Present the technical challenges related to materials and their interactions at elevated temperatures. (c) Overview the thermal and mechanical behavior of materials at high temperatures.

Who Should Attend?: Engineers and technical persons involved in research or development of electronics for high-temperature applications. Familiarity with electronic devices and circuits is an advantage but not a requirement.

Course Description: This course will address the materials and technologies relevant to assembly, packaging and interconnections for high temperatures, above the conventional limit of 125°C to hundreds of degrees C. Copies of the slides, supplementary course notes, and extensive references/bibliographic items are provided. Topics include

- I** - Introduction and definitions, course description, temperature ranges, topics and objectives.
- II** - Basic semiconductor device temperature behavior and limits, focusing on Si, SiC, GaN, C.
- III** - Basic behavior of passive components (resistors, capacitors, inductors) at high temperatures.
- IV** - Materials behavior related to electronic assembly and packaging: thermal conductivity, thermal expansion, heat capacity, thermal diffusivity, electrical conduction, glass transition temperature, strength, temperature capabilities, dielectric properties, magnetic properties.
- V** - Assembly and packaging technology for high temperatures: thin-film, thick-film, die-attach, wirebonding, soldering, packages, interfacing, examples.
- VI** - Reliability and aging, how high temperature differs from room temperature, mechanical stress, failure rates, temperature cycling, examples of case studies.
- VII** - Design issues and ideas: choosing components and layout, resources, custom vs commercial.
- VIII** - References and bibliography.

The topics may be given in a different order or organization from this outline.

Course Presenter: *Dr. Randall Kirschman is an internationally recognized authority on extreme-temperature electronics. He has been consulting to industry, government and academe since 1980 in the areas of microelectronic materials and fabrication technology, and electronics for extreme temperatures. Before going into business for himself in 1982, he managed the processing laboratory at the R&D Center at a division of Eaton Corporation, where he was responsible for the fabrication of thin-film hybrids for microwave components. Prior to that, he was on the staff of the Jet Propulsion Laboratory, performing research on semiconductor materials and devices. He edited the 1999 IEEE Press/Wiley book High-Temperature Electronics. He completed his undergraduate studies at the University of California, and earned his Ph.D. in Physics and Electrical Engineering at the California Institute of Technology in 1972.*

www.ExtremeTemperatureElectronics.com

ELECTRONICS ASSEMBLY AND PACKAGING FOR HIGH TEMPERATURES

PRACTICAL DETAILS

Date: Monday, 5 November 2018

Total course duration: 4 hours (plus breaks and lunch break)

Important: Course may be cancelled if enrollment is insufficient by 5 October 2018.

Tentative schedule

Course: 9:30 to 10:30 am

Break: 10:30 to 10:45 am

Course: 10:45 to 11:45 am

Lunch break (on your own): 11:45 am to 1:30 pm

Course: 1:30 to 2:30 pm

Break: 2:30 to 2:45 pm

Course: 2:45 to 4:00 pm

Venue: To be decided, in Los Gatos, California

Fees

\$380 (full-time students \$260). Additional registrations from the same organization receive the following discounts: 10% first additional registrant, 20% second additional registrant, 30% for third additional registrant, 40% for fourth and subsequent additional registrants.

Enrollment deadline for these prices is 5 October 2018; prices for registration after this date or for on-site registration will be increased by 20%.

Payment may be made by bank transfer or by check. See below on the Registration Form.

Course includes

Printed handouts of slides.

Extensive supplementary course notes.

Bibliography/references list.

Morning and afternoon breaks with refreshments.

Registration Form

I wish to enroll in the professional advancement course *Electronics Assembly and Packaging for High Temperatures*, 5 November 2018 in Los Gatos, California. I agree to the following policies: If enrollment is insufficient by 5 October 2018 the organizer, Dr. Randall Kirschman, may cancel the course and refund all fees. The course organizer reserves the right to cancel the course for any reason and provide a full refund. Cancellation by an enrollee after 5 October 2018, or non-attendance will be subject to a non-refunded administrative charge of \$60. A cancellation notice must be made in writing. All course materials are the property of the course organizer and are not to be transmitted outside the enrollee's organization.

Name:

Organization:

Address:

E-Mail:

_____ Regular: \$380 (or equivalent in € or £). Additional registrations from the same organization receive the following discounts: 10% first additional registrant, 20% second additional registrant, 30% for third additional registrant, 40% for fourth and subsequent additional registrants.

_____ Full-time student: \$260 (or equivalent in € or £).

_____ 20% surcharge for registration after 5 October 2018.

Signature and date

Payment may be made by bank transfer or mail this form with a check or money order. (payment may be made in \$, €, or £)

Dr. Randall Kirschman
P.O. Box 391716
Mountain View, CA 94039-1716
USA

Tel/fax: +1-650-962-0200 (leave a message) (phone beforehand if sending a fax)
E-mail: ExtElect@gmail.com