

ELECTRICAL ARCS – A TECHNICAL CHALLENGE IN POWER ENGINEERING

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Abstract

The seminar will cover basic characteristics of an electrical arc and different roles it plays in power engineering. Electrical arcs have been studied for decades for various applications such as switching arcs in power control and distribution, arc jet thrusters in space propulsion, and arc spraying in material processing. However, understanding of how arcs behave in certain applications is still limited due to the complexities of the physical phenomena. Overview of two aspects of electrical arcs will be presented: electrical arcs in switching devices and arc faults in electrical systems. For engineers and designers developing power switching devices, electrical arcs actually are their 'best friends'. Electrical arcs are important not only in circuit interruption, but also in effectively absorbing energies stored in electrical systems. A brief discussion of arc formation and arc extinction provides a close look at how an arc behaves in a switching device and how magnetic field, materials, high temperature heat transfer and fluid dynamics affect the arc interruption process. Meanwhile, arc faults in electrical power systems cause electric shocks and fire hazards that result in personal injuries and property damages. Arc faults can be categorized into two groups: parallel arc faults and series arc faults. Experimental results show that arc faults can lead to much stronger localized heating and damages than other types of electrical faults. Comparison results also show how the AFCI technology can dramatically minimize the impact of arc faults. An example is given on why changing from 14VDC systems to 42VDC systems for cars presents a major challenge for auto manufacturers.

Speaker's Biographical Sketch

Dr. Xin Zhou received a B.S. degree from Tsinghua University in China and a Ph.D. degree in Mechanical Engineering from the University of Minnesota in 1995. In 1995, he joined Phoenix Solutions Company as a plasma technology specialist developing and designing plasma torch systems for waste remediation. Since 1996, he has been with the Innovation Center of Eaton Corporation working on next generation product development involving arcing phenomena, thermal design, emission spectroscopy and plasma enhanced material processing. He has 22 patents issued or pending, and published over 20 journal and conference papers. He is a senior member of IEEE and has served in various committees of IEEE Holm Conference. He is a recipient of the 1991 IEEE-CHMT Graduate Fellowship Award, the 1993 and the 2003 IEEE Erle Shobert Prize Paper Awards.

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Time: 12:00 – 1:00 PM

Location: 424 Benedum Hall