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## **KEY ELECTRICAL INSULATION TECHNIQUES IN ELECTRIC POWER EQUIPMENT FOR SMART GRID IN POWER TRANSMISSION SYSTEMS**

by

**Professor Hitoshi Okubo, Nagoya University, Nagoya, Japan**

**DATE:** October 17, 2012.

**TIME:** 4:40 p.m. Registration and Networking; 5:00 p.m. – 6:30 p.m. Lecture and question period.

**PLACE:** Delta Centre-ville 777 Université Street, Montréal, QC, H3C 3Z7.

**Abstract** Based on newly developed electrical insulation techniques in transmission and distribution power equipment, the technical perspectives of future applications for Smart Grid in power systems are discussed.

From the view point of insulation materials for the higher electric stress in compact gas insulated equipment, for the solid dielectrics in GIS, functionally graded materials (FGM) with permittivity grading and nano-composite materials can be introduced. The playing roles of FGM including permittivity FGM and conductivity FGM in power equipment are discussed.

From the view point of SF<sub>6</sub> gas substitute, higher voltage vacuum interrupters have been developed, based on electrode conditioning techniques of contact electrode materials and enhancement of creepage insulation performance of solid dielectrics in a vacuum, together with surface charging characteristics.

As for liquid dielectrics, bio-degradable liquids with higher permittivity and flash points were investigated. In addition, the Kerr-electro-optic technique was introduced to directly measure the electric field distribution and hence to clarify the charge behavior in liquid/solid composite dielectrics, under dc and dc polarity reversal conditions, for HVDC power system applications.

Finally, sophisticated measurement techniques on partial discharge (PD) activity as PD-CPWA (Partial Discharge Current Pulse Waveform Analysis) techniques were developed to investigate PD physics. The clarified PD mechanisms contribute to make higher reliability of PD condition monitoring and diagnostic (CMD) systems for stable operation of high voltage power equipment in electric power networks. Not only the CMD for component, but also the CMD concepts for whole power system are proposed, such as IGMS (Intelligent Power Grid Management System). From these viewpoints including the application of Smart Grid, the fault current limiter (FCL) and power flow controller (PFC) are also discussed.

In this presentation, the key electrical insulation techniques in electric power equipment for environment friendly Smart Grid in the future are discussed and summarized.



**Professor Hitoshi Okubo** (M'88) graduated from Nagoya University, Japan with a B.A. degree and Master's degree in 1971 and 1973, respectively. He received the Ph.D. degree in 1984 in electrical engineering from Nagoya University, Japan. He joined Heavy Apparatus Engineering Laboratory of Toshiba Corporation, Japan in 1973 and was a manager of High Voltage Laboratory of Toshiba. Since 1991, he is currently a Professor at the Department of Electrical Engineering and Computer Science in Nagoya University. His research subjects are specializing in the field of electric field calculation and measurement, electrical insulation techniques, the diagnostic techniques for electrical insulation performance in power equipment, related phenomena including partial discharges in gas/liquid/vacuum/solid materials, and functionally graded materials (FGM) and nano-dielectrics, as well as the power applications of high temperature superconductivity (HTS). He is a member of IEEE, IEE of Japan, VDE, CIGRE, ETRA and IEEDJ. In 2011, he was a President of IEE of Japan (IEEJ). Since 2005, he has been an Associate Editor of the IEEE Transactions on Dielectrics and Electrical Insulation. He received the IEEE DEIS Whitehead Memorial Lecture Award in 2011.

**Admission:** Free. Registration required for security reasons,

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