

Vacuum insulation: fundamentals and applications

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EDITORIAL

Vacuum Insulation Fundamentals and Applications

THIS special issue of the TRANSACTIONS ON DIELECTRICS AND ELECTRICAL INSULATION is dedicated to *Vacuum Insulation, Fundamentals and Applications*. The papers published in this issue are based on presentations given at the 18th International Symposium on Discharges and Electrical Insulation in Vacuum (ISDEIV)¹, which was held at the Eindhoven University of Technology in Eindhoven, the Netherlands from 17 to 21 August 1998.

The topics covered in this special issue are:

1. Fundamentals of Discharges and Breakdown in Vacuum (Prebreakdown Phenomena, breakdown and surface flashover)
2. Switching in Vacuum
3. Vacuum Insulation Technology and Applications

Additionally, there is a special Issue of the IEEE TRANSACTIONS ON PLASMA SCIENCE, on *Vacuum Discharge Plasmas*, which deals with vacuum arc fundamentals, applications and devices. From all presentations of which the authors wished their papers reviewed for an IEEE special issue, a careful selection was made by the guest editor, together with the session chairpersons at the symposium. The authors were asked to resubmit a modified and extended version to the regular IEEE reviewing process, resulting in 25 contributions in the field of vacuum insulation (this issue) and 45 contributions in the field of vacuum discharge plasmas (Plasma Science issue).

By and large, the contributions presented in both issues show a balanced mixture of fundamental science and technological applications. Within the fundamental topics covered there is a strong emphasis on *vacuum arcs* and on *electron emission processes*, the majority of contributions coming from the Ukraine and Russia. The applied symposium topics show a variety of technological applications, with an emphasis on vacuum switchgear on the one hand, and vacuum arc applications for deposition, implantation and particle beam production, on the other hand. Furthermore, a considerable number of contributions is related to vacuum insulation.

Another observation is related to the balance between theoretical and experimental contributions. In most Western and Asian countries commercial and economic drives have caused the focus to be directed towards technology and applications, rather than fundamental research. As a result the fundamental work heavily relies on the former Soviet states. The present economic situation there, however, does not allow for expensive experimental facilities. The majority of papers on prebreakdown phenomena, therefore, is of a theoretical nature. In this category especially the papers by Batrakov and Zeitoun-Fakiris serve as

outstanding exceptions. The lack of experimental contributions is troublesome because the establishment of mature theories requires experimental verification. The key to improve this development may be in closer cooperation with the former Soviet states.

Quite the opposite is true for the contributions on vacuum insulation technology and surface flashover, the majority of which is of an experimental nature. The lack of adequate theories and models is felt as a serious drawback for technological progress. It is not the debate on the validity of the different approaches that stands in the way, which became evident also from an informal discussion on surface flashover mechanisms during the symposium. Rather, it is the fact that no single one of the existing theories is able to explain the large number of, and often seemingly contradictory, experiments under different conditions. It is expected that a breakthrough in this stalemate will not be achieved by the search for yet another new mechanism, but by the development of an integral model recognizing the different mechanism active under different conditions.

The above observations reveal two of the major challenges for the scientific community in the coming years: the experimental verification of theoretical prebreakdown concepts, and the establishment of an adequate surface flashover model. Future symposia will reveal whether this challenge is taken up.

During the 1998 symposium Chinese representatives have presented a number of interesting papers, and their contribution will undoubtedly grow to greater technological maturity in the very near future.

The guest editor likes to thank all authors of this issue, as well as the referees and the members of the Permanent International Scientific Committee, for their tremendous efforts which made it possible to have this special issue published in time. A special thank you for Roel Mixk from KEMA, who did a great job in meticulously keeping track of the status of each individual contribution.

Jos Wetzer
Guest Editor

¹ Proceedings available through IEEE Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331. The year 2000 ISDEIV meeting will be hosted by the Xi'an Jiaotong University in Xi'an, P.R. China. Contact the ISDEIV2000 website: <http://www.xjtu.edu.cn/xjnet/temp/ISDEIV/DeivHome.html> or the permanent ISDEIV-website: <http://isdeiv.lbl.gov>

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