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Sombel Diahm, Petru Notingher, G. Teyssevre

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Report on the 1st Thematic School on Dielectrics 2018

Sombel Diaham, Petru Notingher and Gilbert Teyssère

The First Thematic School on Dielectrics was organized under the sponsorship of CNRS – French National Research Center, and supported by DEIS, on Porquerolles Island in France, from 24th to 29th of June 2018. The topic of this first edition was the ageing and reliability of dielectric materials and related structures.



Group picture of the attendees of the Thematic School on Dielectrics 2018, Porquerolles Island, France.

SCOPE OF THE SCHOOL

The ageing, breakdown and life estimation of insulators are ancient problems though of utmost importance in many domains of electrical engineering and electronics. The evolution of power electronics technologies and new high voltage direct currents (HVDC) application introduce new threats for insulation, e.g. high frequency stresses, direct current issues, challenges of thermal endurance, etc. At the same time, material compounding and processing is becoming more and more flexible, and new design possibilities are offered through material functionalization, use of nanocomposites, etc.

This first edition of the Thematic School on Dielectrics 2018 proposed to form a bridge between the old theories

and the new technological opportunities, for researchers, engineers and PhD students in the field of electrical engineering and, most importantly also, opening our field and challenges to materials scientists, chemists and physicists. The School was in the spirit of the Electrical Ageing Workshop, Autrans, France, organized in 2005 and 2008 with IOP support.



The organizers of the Thematic School on Dielectrics. From left to right: Gilbert Teyssèdre, Petru Notingher and Sombel Diahm.

A total of 19 hours of plenary lectures were given on the following topics, involving lecturers from both the electrical engineering domain and from materials science:

- Issues and challenges related to insulation materials
- Theoretical basis on dielectric properties of materials
- Characterization techniques for insulations
- Classical models of ageing and failure modes of dielectrics
- Physico-chemical phenomena in ageing of insulators
- Formulation and elaboration processes of ceramics
- Process and properties of dielectric nanocomposites
- Bio-sourced insulating polymers

The lectures addressed, on the part dedicated to the physics and withstanding of insulations, practical aspects of environmental stresses, new demands for materials and various examples of failure mode. On the materials side, new opportunities for designing materials, with flexibility in properties and opportunities for greener materials were presented. Beyond the courses, the opportunity for participants from different horizons to interact was certainly an invaluable aspect of the school.

Aside from these main courses, which were organized mainly as morning sessions, two activities took place. First, a round table with questions raised by younger researchers was organized in the last session of the school. The most original and demanding aspect of the school in terms of organization and logistics was the training of all participants to various measurement techniques on lab test benches. This latter unique activity was greatly appreciated by the participants.

ORGANIZATION

The Thematic School on Dielectrics was supported by the French National Centre of Scientific Research (CNRS) and the IEEE Dielectrics and Electrical Insulation Society (DEIS). Moreover, the organizers were supported by the French Working Group on Dielectric Materials belonging to the SEEDS-CNRS Electrical Engineering Research Network (<http://seeds.cnrs.fr/>).

The Thematic School was held at the IGESA Center of [Porquerolles Island](#), belonging to the French army as a

recreation and meeting site. Porquerolles Island, on the French Riviera, is a protected area classified as ‘Heart of National Park’ since 2012. Due to accommodation restriction, the island is nearly free from tourists in the evenings making it a quiet and natural place.

The dates were chosen to allow the overseas participants to attend the IEEE International Conference on Dielectrics (ICD), which was organized in Budapest during the following week.



Continuing the discussions during lunchtime and coffee breaks in front of a beautiful sea view.

PARTICIPANTS

For this Thematic School, 64 attendees registered and participated. Among them, 34 were from academia, 13 coming from industry and 17 were students. They came from many countries: UK, Italy, Sweden, Switzerland, Netherlands, Czech Republic, Algeria, South Korea and France. In total, 80 persons joined the event, making it a very successful event in respect to the ambition of the organizers as the full accommodation capacity was used.

LECTURES, PRACTICALS AND INSTRUCTORS

As our objective was to bring international opening to the event, the involvement of the DEIS, broadly advertising the event, and organizing it close to ICD contributed to the school’s success. We also invited international and national experts and involved them within the training program.

Lecturers

- Prof. J. Fothergill, City Univ. of London, UK.
- Prof. S. Gubanski, Univ. of Chalmers, Sweden.
- Prof. A. Vaughan, Univ. of Southampton, UK.
- Prof. S. Holé, Univ. of Paris 6, France.
- Prof. L. Flandin, Univ. of Savoie-Mont Blanc, France.
- Prof. P. Dufour, Univ. of Toulouse, France.
- Prof. J.-P. Habas, Univ. of Montpellier, France.
- Dr. T. Lebey, CNRS, Univ. of Toulouse, France.
- Prof. P. Notingher, Univ. of Montpellier, France.
- Dr. G. Teyssèdre, CNRS, Univ. of Toulouse, France.
- Assoc.-Prof. S. Diahm, Univ. Toulouse, France.



Three among the prestigious lecturers. From left to right: John Fothergill (London City Univ.), Stanislaw Gubanski (Univ. Chalmers) and Alun Vaughan (Univ. Southampton).

Practical work instructors

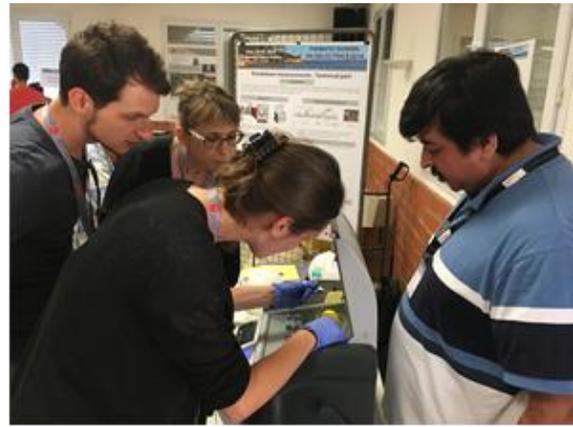
Prof. S. Agnel, Univ. of Montpellier, France.
 Assoc.-Prof. L. Boudou, Univ. of Toulouse, France.
 Assoc.-Prof. J. Castellon, Univ. of Montpellier, France.
 Assoc.-Prof. J.-C. Laurentie, Univ. of Montpellier, France.
 Assoc.-Prof. L. Laudebat, Univ. of Albi, France.
 Assoc.-Prof. N. Lahoud-Dignat, Univ. of Toulouse, France.
 Dr. Z. Valdez Nava, CNRS, Univ. of Toulouse, France.
 Assoc.-Prof. V. Griseri, Univ. of Toulouse, France.
 Eng. N. Guibert, CNRS, Univ. of Toulouse, France.
 Prof. P. Notingher, Univ. of Montpellier, France.
 Dr. G. Teyssèdre, CNRS, Univ. of Toulouse, France.
 Assoc.-Prof. S. Diaham, Univ. of Toulouse, France.

The most specific feature of this Thematic School on Dielectrics was to confront the attendees with direct practical situations by performing specific experimental tasks by themselves.



Thierry Lebey (LAPLACE, left) and Lionel Flandin (Univ. Savoie-Mont Blanc, right) during their lectures with all the attendees.

For that purpose, six experimental setups were brought to the island from LAPLACE and IES Institutes. Characterization techniques covered the different theoretical concepts taught during the lectures. The attendees were trained on dielectric spectroscopy, transient and conduction current measurements, space charge characterization by pulsed electro-acoustic and thermal step methods and dielectric breakdown and statistical analysis. Each attendee followed a total of 8 hours of practical training.



Zarel Valdez-Nava (right) ruling the practical work on dielectric breakdown to Ondrej Seřl (PhD student, TU Prague, Czech Rep.), Marie-Laure Locatelli (CNRS Researcher, France) and Silvia De Giovanni (Engineer, Elantas, Italy).



PhD students and young engineers working in-group on Weibull data analysis after breakdown tests. They are Simone Suraci (Univ. Bologna), Hasti Haghighi (Univ. Manchester), Maria Mitronika (Univ. Nantes), Kim Yu-Min (Engineer, Hyundai Electric and Energy Systems, South Korea) and Jung-Hun Kwon (Engineer, Power Technology Research, South Korea).



Nicolas Guibert from LAPLACE, one of the instructors for the space charge measurements.



Jean-Charles Laurentie from IES, one of the instructors for the dielectric spectroscopy measurements.

The whole program ended with a 2 hour long general open discussion. It was led by Alun Vaughan and Christian Laurent, who earlier asked the PhD students and postdocs to prepare interesting questions.



Alun Vaughan (Univ. Southampton, left) and Christian Laurent (LAPLACE, right) leading the final general discussion with the attendees, particularly the PhD students.

LESSONS LEARNT AND FUTURE OF THE SCHOOL

A questionnaire was distributed among the participants asking for comments regarding school technical content, site

facilities and environment as well as suggestions for improvement. The possibility to attend the practical laboratory training was definitively the very well acknowledged feature of the school, rarely encountered at similar events or forums. As expected, the location was also admired, the latter being strengthened by the sunny weather through the week. Among points for improvement, some comments pointed to the spartan accommodation. As a site intended mainly for leisure of army staff and their families, the comfort is not always a main concern.

As this Thematic School on Dielectric had well responded to the need of our interdisciplinary research community, its second edition is planned to be organized either in 2020 or 2021. The venue will probably remain the same, Porquerolles Island, as it offers the perfect tradeoff between a convenient to reach location and, at the same time, an 'isolated' study environment. The attendees will have a great opportunity to expand their professional network inside and outside the fields of their specialties. We also hope that IEEE DEIS memberships will again be offered to the registered students.

ACKNOWLEDGMENT

The organizers would like to thank the French Scientific National Research Council (CNRS), the SEEDS French Electrical Engineering Network, the IEEE Dielectric and Electrical Insulation Society (DEIS), the LAPLACE and IES Institutes for their financial supports.

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The organizers also thank all the lecturers and instructors for their contributions to setting up the course program and the practical works on the 'insulated island'. Finally, the organizers warmly thank all the participants for coming to share a better insight on Dielectrics.