SYPT 1: Application and New Trends of Plasmatechnology - Part I

Time: Thursday 10:30–12:30 Location: M 00.910

Invited Talk SYPT 1.1 Thu 10:30 M 00.910
Pseudospark Research in Southern California — •Martin Gundersen — Dep. of Physics, and Materials Science Seaver Science Center 421, MC 0483 University of Southern California Los Angeles CA 90089-0483

A historical account of pseudospark research both at the University of Southern California (USC), and in collaboration with U. Erlangen, will be presented. The remarkable properties of pseudosparks, including the super emissive cathode, will be reviewed. Comparison of pseudosparks with traditional thyratrons, which have analogous hold off voltage design and properties, and similar plasma physics for their conductive phase, will be briefly reviewed. The distinction in cathodes will be discussed. More recent work at USC in the development of mini-Back-Lighted Thyratron (BLT switches), which have high voltage hold off advantages and are very compact, will be presented. Areas for further research will be discussed, including the mini-BLTs, cathode issues, and other applications.

Invited Talk SYPT 1.2 Thu 11:00 M 00.910
Features of a hollow-cathode discharge in pseudospark switches — •Yuri Korolev — Institute of High Current Electronics, Siberian Branch, Russian Academy of Sciences (IHCE SB RAS) 2/3 Akademichesky Avenue Tomsk 634055

This paper presents an interpretation of the regimes of the hollow-cathode discharge sustaining in pseudospark switches. As applied to the main gap of the pseudospark switch, the discharge burns at a high-current density in the regimes of dense and superdense glow. In the trigger unit of the switch, we deal with a low-current density discharge with a hollow cathode. For both regimes, the discharge is treated as a self-organizing system that is able to rearrange itself to provide the current requested by external electric circuit. The principal discharge regions in the glow stages are the hollow-cathode plasma, the positive column plasma, and the double electric layer that separates these plasma regions. A model that allows some quantitative estimates when applied to the hollow-cathode plasma is developed. In this model, a generalized secondary emission coefficient that considers an external emission current is introduced. The abrupt transition from dense glow stage to superdense glow stage occurs because of microexplosions at the cathode surface and appearing the metal vapor plasma. In terms of the model, it becomes possible to interpret the main discharge phenomena in a wide range of current density.

Invited Talk SYPT 1.3 Thu 11:30 M 00.910
Overview of R&D Activities on Vacuum and Gas Discharges and Their Applications in South Korea — •Sang Hoon Nam — Pohang Accelerator Laboratory 80 Jigokro 127 Beon-gil, Namgu, Pohang, Gyeongbuk 37673, South Korea

The Pohang Accelerator Laboratory (PAL) is operating the Pohang light source II (PLS-II) and the PAL-XFEL. The PLS-II is a 3rd generation synchrotron light source, which was upgraded from the 15 year-old PLS in 2011. It is consisted of a 3 GeV linac and a 3GeV storage ring (SR). The PAL XFEL is a facility to produce 0.1 nm hard x-ray free electron laser with tens of femto-second pulse-width by using a 10 GeV electron linear accelerator. These facilities use many discharge devices, such as electron guns, thyratrons, klystrons, etc. Thus there have been various vacuum and gas discharge related R&D activities in the PAL; such as pseudospark switches, spark gap switches, triggered vacuum switches, thyratron switch auto-ranging system, pseudospark electron beam source, micro-hollow cathode discharge UV source, related pulse power circuits, etc. Historical and current activities on vacuum and gas discharges and their application in the PAL will be emphasized. In addition, related R&D activities in other institutions in South Korea will also be presented and discussed.

Invited Talk SYPT 1.4 Thu 12:00 M 00.910
Plasma Stripper, Plasma Window, Plasma Gun as Applications of Discharge Plasmas — •Joachim Jacoby — Institut für Angewandte Physik Goethe-Universität Frankfurt Max-von-Laue-Str. 1 60438 Frankfurt am Main

High current, high voltage discharges provide the opportunity to produce a variety of plasmas. We are using e.g. discharges powered from a capacitor bank for our plasma gun to initiate a plasma in a coaxial electrode system near the Paschen-minimum of a gas. By the jxB-forces of this discharge a He-plasma can be accelerated to velocities up to 70 km/s. By directing these accelerated plasma clouds into a glass cone a compression from initial electron densities of 1015 cm-3 to about 1018 cm-3 is achieved. A coil discharge is used to initiate a hydrogen plasma in a glass vessel. The discharge is caused by the inductive coupling of the coil to the gas in the vessel. At these conditions hydrogen may be fully ionized, which is favorable for beam-plasma interaction experiments, because at full ionization the recombination of electrons into projectile particles is reduces and a high beam charge state may be produced. Theoretical and experimental results for these interaction experiments are presented. The possible application of this discharge as a plasma stripper is discussed. A plasma window is an arc discharge inside a small electrode system. This discharge plasma is used to enhance the pressure difference between the cathode and the anode of the discharge. First results demonstrate the expected pressure difference caused by the discharge. Together with a moderate pumping a pressure reduction of about a factor 100 could be demonstrated yet.