Present and Future Views of the Division of Plasma Electronics

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The Division of Plasma Electronics (DPE) has approximately 460 members and carries out activities to promote low-temperature plasma science and technology by sponsoring topical meetings, tutorial meetings, bulletin publications, and so on. The DPE also works closely with the Radiation/Plasma Electronics Section in the JSAP spring and autumn meetings, where scientific sessions are organized under the categories of Plasma Sources and Production Technologies, Diagnostics of Reactive Plasmas, Plasma-Based Material Processing, Nano-technologies through Plasma Processes, and General Topics regarding Plasma Discharges.

The DPE originated from the Professional Group in Plasma Electronics (PGPE) which was organized in JSAP in 1985. At that time, the field of plasma application to materials and device processing was in its initial phase of development but the discharge and plasma related sessions in the JSAP regular meetings were rather inactive regarding this field. Recognizing the importance of advancing the field, PGPE members set up the Plasma Electronics section in the JSAP regular meetings and also began to organize an annual topical meeting, the Symposium on Plasma Processing (SPP). They also jointly organized an annual meeting for the discussion of lighting plasma science and technology with the Illuminating Engineering Institute of Japan. With the growing interest in and industrial needs regarding plasma technology in materials processing, PGPE rapidly increased its membership and became a division of JSAP (DPE) in 1990. While SPP-2 in 1985 mainly consisted of arranged sessions with approximately 60 presentations, SPP-7 in 1990 had approximately 130 presentations including invited and contributed papers; also, while the Proceedings of SPP were prepared in Japanese for the first few meetings (with many hand-written papers), those after 1988 have been published in English to reflect the importance of international information exchange. Since its establishment, the DPE has steadily extended the range of its activities. Since 1990, DPE has provided a plasma short course every year; since 1994, it has also sponsored a Plasma Summer School held annually in beautiful mountain areas of Japan for graduate students and people in industry entering this field.

The SPP, the central activity of the DPE, has grown into a meeting of international renown. Since 1991, approximately once every three years, the SPP has been held as an international conference – the International Conference on Reactive Plasmas (ICRP) – under the auspices of JSAP. In 1998, ICRP-4 was jointly held (in Maui) with the 51st Gaseous Electronics Conference (GEC), which is a United States based annual conference with many international participants. In 2002, ICRP-5 was jointly held (in Grenoble) with the 16th European Conference on Atomic & Molecular Physics of Ionized Gases (ESCAMPIG). These meetings have greatly contributed to strengthening the international relationship between scientists and engineers working in the field of plasma electronics. In 2001, major plasma-related organizations in Japan held the Plasma Science Symposium 2001 (PSS-2001), which covered an extensive range of plasma fields including industrial applications of low-temperature and thermal plasmas, fusion plasmas, space plasmas, and so on; SPP-18 was jointly held with PSS-2001 and the DPE acted as the managing society in organizing the conference. The latest SPP (SPP-21) was held in Sapporo as a regular domestic meeting, having approximately 160 invited and contributed papers. In the 2003 fiscal year, the DPE also sponsored the International Workshop on Plasma Nano-technology and its Future Vision (an extended version of the Vision meeting, which DPS has organized every year since 2000).

In the past two decades, great advances have been made in the field of plasma electronics, and members of the DPE have made significant contributions to these advances. In particular, many DPE members have participated in two research projects supported by MEXT Grants-in-Aid for Scientific Research of Priority Areas – Control of Reactive Plasmas (1988-1990) and Free Radical Science (1993-1996) – which have deepened and expanded our fundamental knowledge concerning plasma electronics. Understanding the principles of controlling the plasma parameters in various plasma sources has been deepened significantly, and it is now common practice to discuss chemical processes in reactive plasmas based on the measured free radical densities.

Nano-scale precision plasma processing is required to fabricate semiconductor ULSIs, whose dimensions are ever shrinking, while above-meter-scale plasma sources with high uniformity are needed in flat panel displays. Great challenges and numerous problems remain to be overcome before we will be able to produce plasmas of any desired size with well controlled plasma parameters. At the same time, however, many believe that the field of semiconductor device process technology, which has been a driving force for advances in plasma electronics, is entering a mature phase. If this is true, how the DPE can best maintain or raise further its current high level of activity is a question that deserves serious consideration. Novel forms of plasma production in new parameter regions and subsequent applications are the targets of intense study under a MEXT Priority-Area Grant-in-Aid for Scientific Research – Generation of Micro-Scale Reactive Plasmas and Development of Their New Applications. Activities in emerging fields, such as plasma applications to bio/life science, environmental technology, and nano-technology, are growing. We should actively pursue and encourage interaction with those working in different fields, while also strengthening the scientific foundations of our own field to enable the realization of effective synergies through such interactions.

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