THE 33rd International Conference on Plasma Science (ICOPS) was held in Traverse City, MI, in June 2006. It was chaired by Prof. Jes Asmussen and cochaired by Prof. Timothy Grotjohn with over 400 attendees from around the world. Over 400 papers were presented at the conference. This special issue focuses on the Plenary and Invited Papers presented at ICOPS. Contributed and poster papers at ICOPS are encouraged to submit regular papers to IEEE TRANSACTIONS ON PLASMA SCIENCE.

Thirteen referred papers from the plenary and invited talks are in this Special Issue. The papers are from a range of plasma science topics including high-energy density plasmas, atmospheric pressure plasmas, microwave generation, thermal plasma torches, and applications of plasmas to biomedical, nanotechnology, displays, lighting, and plasma-assisted combustion. In the area of Z-pinch and high-energy density plasmas, Bott et al. present an experimental study using imaging and X-ray diagnostics of the precursor column formation in wire array Z-pinch. Ottinger and Schumer present a model of the power flow in a Z-pinch-driven inertial fusion energy system that utilizes a recyclable transmission line. Drake presents a study of radiative shocks in optical thick media by looking at the fluid theory and using a model for the radiative transfer that yields a description of the shock structure. In the area of atmospheric pressure plasma discharges, the paper by Hopfe and Sheel examines the use of atmospheric plasmas for coating and etching applications. Plasma sources they consider include microwave chemical-vapor deposition (CVD), linear-shaped plasma dc ArcJet CVD, and dielectric barrier glow discharge CVD. Shi, Liu, and Kong examine the operation and properties of dielectric-barrier radio-frequency atmospheric pressure glow discharges. Roth et al. examine several applications of atmospheric pressure discharges based on the One Atmosphere Uniform Glow Discharge Plasma technology. In the area of thermal plasmas, Tanaka et al. present a study of independently controlling the atomic nitrogen flux and the enthalpy flow, from an induction thermal Ar–N2 plasma torch, by modulating the coil current. In the area of microwave generation, Thumm et al. present experimental results on a new megawatt class design for a gyrotron operating at 140 GHz. This gyrotron is designed for use as the millimeter-wave power source for heating plasmas to high temperatures for fusion reactions.

Several of the papers in this Special Issue present studies of the application of plasmas. Chu presents a paper on plasma-treated biomaterials that looks at the use of atmospheric pressure plasma spraying and plasma immersion ion implantation. Applications discussed include orthopedic implants, biocompatible coatings, and antibacterial coatings. Ostrikov overviews the ways that plasmas are used in nanoscience areas. Examples from nature and nanofabrication in the laboratory are discussed. Park et al. present work on making 20 × 20 and 50 × 50 addressable arrays of microcavity discharges that are built based on dielectric barrier designs. Paul et al. developed a 3-D model for high-intensity discharge lamps. The model results are validated by comparison to experimental temperature measurements of a test lamp. Vincent-Randonnier et al. describe a study and experimental test bench for plasma-assisted combustion using a dielectric barrier discharge to assist a methane diffusion flame.

We would like to thank all the referees for the papers in this Special Issue. A special thanks is also due to Dr. S. Gitomer, Editor-in-Chief of the IEEE TRANSACTIONS ON PLASMA SCIENCE, for his guidance and support during the formation of this Special Issue.

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