APEX and ALPS, High Power Density Technology Programs in the U.S.*

Clement Wong† reporting for Sam Berk,‡ M. Abdou,# and R. Mattas+

In fiscal year 1998 two new fusion technology programs were initiated in the United States, with the goal of making marked progress in the scientific understanding of technologies and materials required to withstand high plasma heat flux and neutron wall loads. The Advanced Power EXtraction program (APEX) is exploring new and "revolutionary" concepts that can provide the capability to extract heat efficiently from a system with high neutron and surface heat loads while satisfying all the fusion power technology requirements and achieving maximum reliability, maintainability, safety, and environmental acceptability. The Advanced Limiter-Plasma-facing Surface (ALPS) program is evaluating advaned concepts including liquid surface divertor on the basis of such factors as their compatibility with fusion plasma, high power density handling capabilities, engineering feasibility, lifetime, safety and R&D requirements.

Some of the possible advantages of using liquid surfaces in divertors, first wall and blanket applications relative to conventional solid surface approaches are: higher surface heat flux and neutron wall load handling capabilities. These capabilities are necessary to exploit advanced plasma modes that allow high power density operation. Additional potential advantages are: continuously renewable surface, which could significantly enhance divertor lifetime by reducing concerns about sputtering and disruption erosion, and higher temperature operation, which could significantly improve thermal power conversion efficiencies. The APEX and ALPS programs are to specify requirements and evaluate criteria for revolutionary approaches including liquid plasma-facing surface concepts in FW/blanket and high heat flux component applications. Conceptual design and analysis of candidate concepts are being performed with the goal of selecting the most promising FW/blanket and high heat flux component designs.

These three-year programs have the participation of a multi-disciplinary team involving several organizations including UCLA (leading the APEX program), ANL (leading the ALPS program), ORNL, SNL, LLNL, GA, UCSD, PPPL, INEL, UIUC and UW at Madison. These programs are also considering opportunities for international collaborations.

This paper reports on the planning and status of the first year of these programs. Concepts being investigated will also be presented.

---

*Work supported by U.S. Department of Energy under Contract No. DE-AC03-98ER54411.

†Fusion Group, General Atomics, San Diego, California, USA.

‡Office of Fusion Energy Sciences, Office of Energy Research, U.S. Department of Energy Washington, DC.

#School of Engineering and Applied Science, University of California, Los Angeles.

+Fusion Power Program, Argonne National Laboratory, Argonne, Illinois.