

EXECUTIVE SUMMARY
MATERIALS ADVANCES SESSION CQ7 (July 15-16, 1999)
Snowmass Chamber Science & Technology, August 4, 1999

Materials sessions were conducted at Snowmass to discuss potential advances in materials (over the next decade) that would: improve the vision for an attractive and competitive fusion energy system and contribute to the lowering of the cost and time for R&D. M. Billone and S. Zinkle co-chaired the sessions. A. Rowcliffe served as recorder. Presentations were made in the areas of: structural materials for first-wall/blanket applications; non-structural materials for plasma-facing components, tritium solid breeders, Be multiplier, liquid metal/salt coolants and breeders, shielding material, waste management strategies, large-scale experimental facilities, material needs for IFE reactor concepts, and energy issues. Common themes were: the importance of studying materials in combination (e.g., structural-materials/coating/coolant), the necessity of design optimization studies for evaluating materials performance and prioritizing materials R&D, and the desirability of conducting R&D that would serve both MFE and IFE needs. Key materials needs to support feasibility and proof-of-principle issues for reactor design concepts and R&D plans to address these needs were discussed. Thirty-five people participated in the sessions. Major opportunities highlighted during the sessions are summarized in the following.

Consideration of New and Improved Alloys: The Advanced Materials Program (AMP) R&D efforts are focused on three low-activation structural materials (vanadium alloys, ferritic steels and SiC/SiC), along with a small effort on copper alloys for next-step devices. Performance tradeoffs among high power density, longer lifetime, and activation and waste volume minimization could allow some relaxation of the severe restrictions on alloy composition currently in place. This would provide the much-needed flexibility for developing higher performance structural materials. Examples include consideration of improved W and Mo alloys and evaluation of more oxygen- and creep-resistant vanadium alloys (e.g., V-Ti-Al).

Near-term, Cost-effective R&D: Reactor designs range from low-performance, next-step devices to intermediate-to-high-performance concepts (e.g., solid first walls with He or liquid metal coolants) to very high-power-density concepts (e.g., liquid walls, He-cooled refractory metals). A wide range of materials feasibility and proof-of-principle issues could be addressed in the next decade using existing facilities and new low-cost, non-nuclear facilities. Examples of these issues are: chemical compatibility between structural materials and liquid metals/salts, reliability of electrical-insulator and tritium-barrier ceramic coatings, and neutron radiation stability of improved W and Mo alloys. The current AMP roadmap is based on the highest-priority issues for three low-activation structural materials. An expanded “fusion technology” materials roadmap may be needed to include the broader range of coolants and solid materials.

Integration of Materials R&D: The Advanced Materials Program focuses on structural materials, while other programs within Advanced-, Enabling- and IFE-Chamber-Technologies deal with a wide range of structural and non-structural materials. Integration of the materials R&D (or at least improved communication) within the chamber technology areas offers the potential of utilizing the best materials expertise to address materials issues. A coordination group would be useful to facilitate interaction and communication among the various technologies concerned with materials-related issues.