MRS Hosts Meeting of Congressional Advanced Materials Caucus

The Materials Research Society hosted a breakfast meeting of the Congressional Advanced Materials Caucus on July 17 at the Hart Senate Office Building in Washington, DC. The caucus includes approximately 35 senators and representatives and their staffs who meet periodically to discuss materials issues.

Senator John McCain (R-Arizona), chairman of the caucus, presided over the meeting, which focused on a briefing by Bill Appleton, chairman of the National Research Council's Solid State Sciences Committee. Appleton spoke about *A National Agenda in Materials Science and Engineering: A Report from the Regional Meetings*, a recently published consensus report derived from a series of regional meetings held to find ways to implement the recommendations of the MS&E study.

Appleton, who is associate director for physical sciences and advanced materials at Oak Ridge National Laboratory and a former MRS councillor, emphasized the impact of materials science and engineering on many sectors of society and reviewed the history of actions by the Congress and the Office of Science and Technology Policy (OSTP) to stimulate MS&E planning. This history included publication of the NRC report, *Materials Science and Engineering for the 1990s* (the "MS&E study"), the subsequent regional grassroots meetings on MS&E, and the combination of the regional meeting reports into a national consensus document, *A National Agenda in Materials Science and Engineering* (see *MRS Bulletin*, April 1991, p. 22).

The "national agenda" report recommends specific MS&E initiatives that contribute to areas of national need, identifies mechanisms for increased government-university-industry partnerships, recommends an approach for strategic planning for future MS&E initiatives, and provides input for the current OSTP crosscutting initiative in MS&E. The report identifies needs for health, environment, and maintaining leadership in materials. These initiatives, totaling $1.25 billion per year, underpin virtually all the "national critical technologies" as identified by OSTP, the Department of Commerce, and the Department of Defense.

In his remarks, Appleton stressed the importance of national, coordinated planning in MS&E and the emergence of synthesis and processing as an underlying theme. He reiterated the need to establish clear national goals in MS&E where incremental funding can make a significant difference. He also encouraged the involvement of industry, universities, and government laboratories as partners in the federal planning process.

The OSTP, through the Federal Coordinating Council for Science, Engineering, and Technology and COMAT Committees, is currently coordinating MS&E crosscuts among the major funding agencies and federal offices for consideration as a potential initiative for the FY 1993 budgets. This would follow national crosscutting initiatives already ongoing in high performance computing and global climate change.

Bill Appleton (2nd from right), speaker at the MRS-hosted Congressional Advanced Materials Caucus meeting, with (left to right) MRS President James B. Robert, Senator John McCain, and Ron Kelley from the MRS Office of Public Affairs.

Continued Heart Device Research Urged

The Institute of Medicine recently released a report urging the National Heart, Lung, and Blood Institute (NHLBI) to continue research support for the total artificial heart (TAH) and the ventricular assist device (VAD), a mechanism that pumps blood to and from the heart, assisting one or both ventricles. The committee report is the result of a request by NHLBI, the only public source of funds for artificial heart research, to review its artificial heart research program and make recommendations on how to proceed.

The committee concluded that continued but limited funding is warranted on the total artificial heart, but if, within the next few years, substantial headway is not made to improve the cost-effectiveness of TAHs, "NHLBI's proper course in 1994 or 1995 may well be to suspend all support of TAH development until further VAD experience has been gained." Currently, the TAH has poor cost effectiveness when compared with other technologies such as heart transplantation or coronary artery

https://doi.org/10.1557/S0883769400055986 Published online by Cambridge University Press

bypass surgery. A TAH is expected to cost about $200,000 in 1991 dollars including hospital and physician fees.

The committee sees the VAD as essential in the interim before the TAH gains FDA approval, not likely until 2005. Clinical trials on a long-term, fully implantable VAD are scheduled to begin in 1992. Such devices are currently in short-term use on patients awaiting heart transplants.

Two major complications with using artificial heart devices are bleeding and thromboembolism, the blocking of a blood vessel by a blood clot particle that has broken away from the clot where it formed. "Improved materials, as well as improved hemodynamic designs of these devices, can lower not only thrombosis but bleeding," according to the report.

Thromboembolism is a function of the materials used in the blood pump, the cleanliness and surface characteristics of that material, the physical geometry within the pump, the presence of cracks or crevices, and the careful matching of materials within the blood pump. Thrombosis is design and manufacturing sensitive.

Materials used in the manufacturing of blood pumps include various stainless steels, titanium, alloy steel such as Vitalium, polymeric materials such as Delrin, Teflon, polycarbonate, and polysulfone, and elastomers such as polyurethane, Hexin rubber, silicone rubber, and Dacron.

The most widely used polymer for mechanical circulatory support systems is polyurethane. Design goals include developing materials that are more biocompatible, fatigue resistant, and easy to fabricate. Surface modification of new and existing polymers is another method of improving biocompatibility. Bonding of a heparin-like substance to the surface of the material can improve the thrombogenicity of polymeric materials. Ion implantation can change the surface structure to improve mechanical properties of polymers as well as biocompatibility. Surfaces may also be coated with carbon. Surface charge and surface energy may play a role in thrombogenicity and also may be altered through surface modification.

Ion implantation into metals is used to change the physical and chemical properties of metals and is used today to selectively increase corrosion resistance, hardness, wear resistance, and other surface sensitive properties, without affecting dimensions. Likewise, thermally sprayed coatings can be used to produce the required surface quality such as wear resistance, solderability, or thermal barrier characteristics.

Amorphous metals can improve motor performance and are beginning to compete with the metallic strips and large ferrite cores in magnetic devices operating from 100 to 200 kilohertz.

Meanwhile, ceramics such as alumina, aluminum silicate, carbon/graphite, silicone nitride, titanium diboride, boron nitride, Macor from Corning Glass, and partially stabilized zirconia are gaining attention as promising materials for use in the body.

The report, The Artificial Heart: Prototypes, Policies, and Patients, *will be available in October for $24.95 (prepaid) plus $3.00 shipping from the National Academy Press, 2101 Constitution Ave, N.W., Washington, D.C. 20418, (202)334-3313 or (800) 624-6242.* □

https://doi.org/10.1557/S0883769400055986 Published online by Cambridge University Press