

Behind the Themes and Between the Lines

Materials Challenges for the Next Century

If we watch ourselves honestly we shall often find that we have begun to argue against a new idea even before it has been completely stated.

—Wilfred Batten Lewis Trotter
(1872–1939) English surgeon

When we initiated a new department on MATERIALS CHALLENGES FOR THE NEXT CENTURY, we should have demurred a bit. It is not easy in the best of circumstances to distance oneself from current research pursuits. We were asking our authors both to broaden their outlook to cover a broad societal sector such as habitat or information technology, and then to step out of the safe haven of completed, reviewed, and published research. The feature was to play to the creative side of science, an outlet essential for breaking mindsets that limit our thinking, but counter to the rigorous scientific process used to prove or disprove hypotheses that occupies most of our time as researchers. Inspiration without perspiration has the danger of being only science fiction. However, perspiration alone does not challenge the boundaries of knowledge.

In this series, we invited our authors to challenge their thinking and step through the door to the unknown. While many were eager to peer out the door, few walked through comfortably. Perhaps the concern over being proven wrong in one's speculations was too strong. Instead, caution led to articles that focused more on issues of today and the known roadmap into the near future instead of opening up opportunities for the unknown road for decades to come. This was, perhaps, the appropriate place to start. But to be too "short-sighted" in projections can be limiting. We laugh now at



T.J. Watson's assessment in 1943 that "there is a world market for maybe five computers" and Lord Kelvin's comment in 1895 that "heavier-than-air flying machines are impossible."

We must overcome these roadblocks in our thinking if we are to design an agenda for the future of materials. Speculations are just speculations with no guarantee of their relevance or even their correctness. But then when they are debated and scrutinized by scientists and technologists, they could lead to a possible agenda for materials development in the new century. It is for this reason that we quoted in our introduction J.D. Bernal, who did not hesitate to talk of space travel (at a time when no one thought of launching satellites) or even of immortality (while DNA sequencing would come later). We must therefore be risky and bold in setting our agenda. Have we, for instance, thought of unlimited solar power in the form of microwave-energy beams straight from geostationary satellites, solving problems of energy and water for our global universe, or even of new memory devices that store more than a few terabytes of instructions within a square inch—making a mockery of the

human brain's immense storage capacity? Have we thought of automobiles that use no fossil fuel but instead use pure and seemingly limitless hydrogen, or of the issues behind developing routinely rejuvenating or replaceable organs?

Science with its limitless possibilities should not constrain us to merely speculate on beaten tracks. The caution with which scientists avoid far-out speculation gives the impression that thinking of the impossible will vaporize the possible. It is really quite the opposite. Among ideas meant for science fiction are bound to be some sound ideas that can—shall we say—materialize. Remember the science fiction writer Arthur C. Clarke talking of steady and stable satellites over us well before geosynchronous satellites became a reality?

We persuade our authors in this series to be adventurous, to think far ahead, to take a few risks. Russ R. Chianelli's article in this issue of *MRS Bulletin* (p. 57) does just that. Some of the ideas may make readers uncomfortable. The author himself admitted to such misgivings. It is much easier and safer to only talk about what is known and what for the future is already universally acceptable. Stirring the mix still more, Robert W. Cahn's article in this issue (p. 59) questions the unquestioned answers. So often the past is accepted as fact, with the future forced to follow in line. Cahn's article reveals the vulnerability of what is "known" and presents opportunities that such questioning can bring.

The challenge, then, is to imagine the possibilities that appear clearly impossible today, but for some materials. After all, we can debate the validity and value of these projections in our coffee rooms and faculty lounges.

V.S. ARUNACHALAM
AND E.L. FLEISCHER

"Habitat: Sensors may be used to measure wind speeds or earthquake-generated pressures and provide for a temporary increase in strength at anchorage points of the roof and other vulnerable locations."

"We look forward to the tube of biomedical 'glue' which we simply squeeze on to a cut to seal and heal it."

"A single disk with a petabit of storage would provide approximately a movie a day for over 60 years."



"Many of our human parts will be replaced with better materials: hearts, lungs, and kidneys that never wear out, only needing a tune-up from time to time."

What will the century uncover in materials?

"One of the 'dreams' of AMLCD technology has been to develop a noncontact-alignment process."

"Cities may be built under the sea for security, with access to fish farms and photosynthetic harvests."

What do you think? Send in a Letter to the Editor with your ideas of Materials Challenges for the Next Century:
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