Concluding Remarks

Dr. N. Eaton

The objective of the Symposium, as stated in the introduction was to visualize the strategy for innovation in material processing as we move towards the 21st century.
Meeting as we were, at the Japan Welding Research Instutute, it is interesting that not only have we covered metals and alloys but ceramics, composites, polymers and bio-materials. Moreover traditional welding has been re-emphasized in the broader context of joining. Indeed I would re-define joining as the "science of inter-facial adhesion phenomena".

The first Session did not strictly deal with interfacial adhesion but the processing of materials. The theme which evolved emphasized the interaction and linkage between three key areas of Energy Sources, –Materials– Processes. This interactive linkage set the scene for the following sessions.

Session Two introduced the expanding field of surface modification, which from a practical point of view, provides an excellent engineering solution for achieving material property requirements in service environments.
The adoption of processes orginally developed for welding, arcs, plasma, electrons and lasers as energy sources for surface treatment is particularly interesting. It is significant to observe that much of the research at JWRI, has moved from joining to surface modification.
Coating Technology is an exciting field and the excellent ATTAC conference over the weekend illustrated this, and is extended into this present symposium.

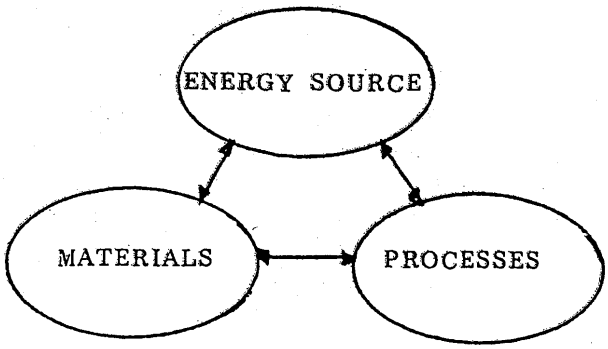
Session Three introduced many of us to the new area of bio-materials. Here in addition to materials development, we saw the importance of interfacial science, in the joining of transplant connections, and in the structural performance of implants.
This highlighted a very important aspect of the symposium–the interaction between the disciplines of medicine, biology and materials. The ability for nature to interact on a microbiological scale between animal/human bone and tissue with chemically manufactured materials like hydroxyapatite perhaps points the way to the future in advanced materials joining. A topic not covered in the symposium, but again an example of microrganisium interaction with materials, is biological induced corrosion. In the future, will we see the harnessing of living species for the joining of materials–as an extension of the new science of biotechnology? Perhaps an untapped energy source awaits us?

Session Four brought some of us, certainly myself back to more familiar ground of welding and joining. While we look to the future in materials and processing, I urge the science community not to neglect the past and more traditional technologies. Problems in traditional materials and processes will continue, and expertise in this areas must be maintianed. Do not move so far into the future that present suffers!

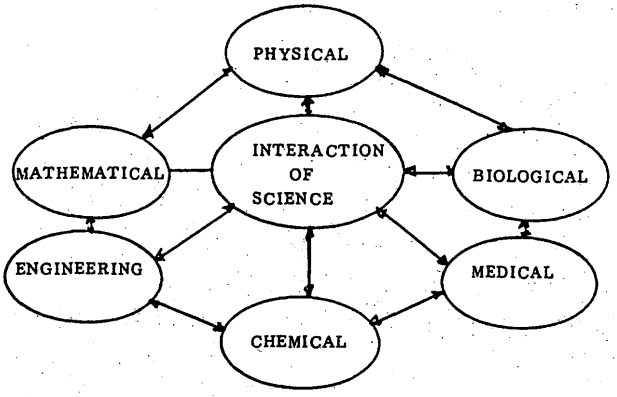
Session Five on computer science brought us a picture of the power of the systems now at our disposal for computational analysis, and intelligent systems for automation and control, However, to not forget the paper on the ancient joining technology of soldering–without this the modern electronic world would not exist.

Session Six brought us back to earth, and even additionally, deep into the ocean and up into space, and showed the importance of materials in energy development and rail transportation.
The engineering applications of advanced materials discussed in this session were exciting and should remind us of the purpose of materials science. Our search for fundamental understanding must be linked to advancing the application of enginering structures around us.

In Summarizing my Conclusions
I would indicate that the initial theme was the interaction of energy, materials and processes.



As we progressed through the presentations, my conclusion was that the strategy for the future is clearly the interfacial interaction of science, where a variety of disciplines can meet and work "face-to-face".



The initiative of JWRI in bringing together this multi science–multi discipline symposium is very interesting.

As an old time welding engineer I have noted the change of name of the Osaka University Department of Welding Engineering into the Department of Materials Processing and Productivity Engineering. In Japanese the name welding has been dropped. One interesting objective I understand is to attract students to the department. However, as I already pointed out present problems in welding and joining will remain and I trust that future graduates will not be experienced only in advanced materials and processes.

A balance of technologies and research, traditional and advanced is a vital strategy for the future.

One of the strengths of Japan, as viewed by those from outside your country, is the importance and value of the maintenance of both your ancient culture and traditions in a rapidly changing advanced technology era.–Let not the future of science and technology lose the value of the ancient traditions of conventional materials and processing technologies–**We must maintain the cultural Interface.**

Finally as a visitor to your wonderful country, emminent University at Osaka, and outstanding Institute JWRI (still, I am pleased to know, called the Welding Research Institute)–I thank all our Japanese hosts, on behalf of all your visitors, for an excition, stimulating and most pleasurable symposium.