Fourth Conference on Rapid Solidification Processing: Principles and Technologies

On December 15-18, 1986 the fourth in a series of conferences on rapid solidification processing was held at the University of California's Santa Barbara campus. The first and second in this series were held in Reston, Virginia in 1977 and 1980. The third was held at the National Bureau of Standards in Gaithersburg, Maryland in December 1982. In the four years that have elapsed since the last gathering, a good deal of progress has been made in understanding rapid solidification processes in metals and alloys and in the processing technology itself. This fourth conference was organized and cochaired by Robert Mehrabian, dean of engineering at the University of California's Santa Barbara campus. Morris Cohen (Massachusetts Institute of Technology) and Phillip Parish (Defense Advanced Research Projects Agency) also cochaired the conference steering committee. Supported by DARPA, the conference drew approximately 100 participants with representatives from university, industry, and government laboratories as well as funding agencies.

Because the subject matter was to span fundamentals through applications-oriented presentations and because rapid solidification processing (RSP) is on the critical technologies list subject to export controls, attendance was limited to U.S. citizens and residents. Distribution of the conference proceedings will be similarly restricted. Much of the conference, however, was in the basic area and individual preprints can be distributed more widely. Readers are encouraged to contact Prof. Mehrabian for a list of participants from whom copies of papers may be obtained.

The program was organized into seven sessions plus a workshop. The sessions dealt with fundamentals of RSP, alloy design for RSP, microstructures and properties, advances in processing, interface kinetics and surface modification, consolidation and forming, and applications. The workshop was subdivided into three components. One dealt with critical experiments and theory at the fundamental level; another dealt with process modeling, sensors, and control aspects of the processing of rapidly solidified materials; and the third dealt with applications of RSP and "roadblocks" thereto. The most notable advances occurred in understanding the kinetics of solidification in terms of nucleation and growth and in terms of modeling at an evermore microscopic level. Because the area of rapid solidification dealing with the formation of amorphous or glassy phases is covered in so many other forums, this topic was explicitly omitted from the conference.

R. Mehrabian, dean of engineering, University of California at Santa Barbara, opens the Fourth Conference on Rapid Solidification Processing.

Prof. F. Spaepen of Harvard lectures on undercooling and metastable phase formation.

Considerable discussion centered around reasons for a lack of rapid introduction of RSP materials into the manufactured goods environment. Though there are some necessary uses for RSP materials, such as in high-temperature nickel-based super alloys, the participants generally agreed on the existence of a variety of "roadblocks" to the rapid introduction of this technology. It was concluded that without a quantum leap in economic or technical advantage, it is unlikely that RSP will be introduced in a large way through only incremental improvements.

Considerable emphasis was given to the lack of adequate process control capability, particularly in gas atomization where the need exists to measure particle size distributions and to control the process in real time so that the distribution remains appropriately narrow. Several comments concerned new developments in diagnostic techniques which may lead to these capabilities in the not too distant future. In fundamental studies, considerable experimental progress has been made in measuring basic parameters such as liquid-solid interface velocities, interface undercooling, and so forth.

W.J. Boettinger, National Bureau of Standards, discusses the use of dendritic growth theory in interpreting RSP microstructures.

The conference banquet was to have included a talk by former Presidential Science Advisor, George Keyworth, who was unable to attend due to illness. Instead, Peter B. Bridenbaugh, vice president for research and development at ALCOA, spoke about the adjustment that ALCOA has made in many segments of its business to the realities of the modern U.S. technological posture in materials. Of particular interest to readers of the MRS BULLETIN is that ALCOA consciously reinforced its basic and developmental research efforts after observing that its "pipeline" of research results was not being maintained and that 85% of new technical ideas were actually successful. This, according to Bridenbaugh, indicated inadequate risk-taking at the research level—in stark contrast to other industrial research organizations where severe cutbacks have been and are in progress.

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https://doi.org/10.1557/S0883769400068937 Published online by Cambridge University Press