Summary

The first objective of this symposium was to define the testing procedures needed for metal matrix composites. The second objective was to gain an understanding of the physical and theoretical behavior.

The mechanics of how to do tests was addressed by several authors. It is also obvious that the test methods for short fiber reinforced metal matrix composites is quite different from those for long fiber reinforced metal matrix composites. The test specimens made for composites with short fibers (whisker or particulate) and their procedures are based upon test methods derived from isotropic homogenious metals. The best discussion of the methods is the work by co-editor *DiGiovanni et al.* They discuss tensile, flexure, and bearing. Besides ambient temperature tests they did elevated temperature tests. Compression tests are discussed by authors *Awerbuch et al.*, *Chou et al.*, and *Bethoney et al.* The procedures seem to be such that standard test methods could be drafted. The ASTM Committee D-30 on High Modulus Fibers and Their Composites has instituted a task group to draft these standards. Several papers discussed toughness testing, but there does not seem to be a shear test method.

While the methods of evaluating metal matrix composites made with short fibers seem to exist, the methods for evaluating metal matrix composites made with long fibers are not as developed. The most developed test method seems to be the tension test method and, in fact, a standard (D 3552) does exist. The various tension tests are discussed in at least four papers. *Majidi et al.* discussed compression, shear, and toughness tests. *Francini* discussed test methods for tubural configurations. Clearly more effort will be needed in order to define a standard.

One important use of metal matrix composites may well be in thermally stable structures. For this class of applications the important properties are the coefficient of thermal expansion (CTE) and the modulus of elasticity. The CTE measurement methods are discussed very aptly by *Tompkins and Dries*. Several papers discuss the measurement of the modulus by ultrasonic methods rather than by mechanical methods. For these type of applications this appears to be a good technique.

Nondestructive evaluation of materials is important in any application. The work reported here shows that the effort related to metal matrix composites is still in its infancy and more effort is needed.

Beside simply measuring properties, there is a clear need to understand the implication of the findings. The two papers presented by *Chamis and Hopkins* and one by *Adams* clearly helps the investigator to do this.

Finally, if metal matrix composites are to be used, the data must be statistically based. The work by *Wu and Chou* is exemplary in the understanding of scatter in composites. His work shows the effects of the matrix in reducing the scatter. *Harmsworth* discusses the direction that we must proceed in order to obtain true statistically based allowables.

As this summary is being prepared a second conference on testing of metal matrix composites is being planned. The new effort will discuss the efforts in the last two years since this conference was held. The new finds should be also prepared as a special technical publication in the future.

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