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Foreword

Ceramic Matrix Composites (CMCs) are considered as promising materials in different fields of applications including rocket, jet and reciprocating engines, heat shields and hot structures for space vehicles, wear resistant parts and cutting tools, components for heat treatment furnaces, first wall of nuclear fusion reactors, bone prostheses, etc.... Their main advantages with respect to monolithic ceramics are a higher toughness and a much better reliability (some of them being almost insensitive to notch effect).

CMCs is a generic acronym covering different families of composites where the reinforcing phase consists either of particulates, short fibers (such as cut fibers or whiskers) or continuous fibers. Although it is often used for materials with continuous fibers, in the present issue of the *Journal of the European Ceramic Society*, it is used with its general meaning, designating two-phase ceramics, one phase reinforcing at least to some extent the other.

CMCs are still extremely recent materials when compared to other more conventional structural ceramics. As a result they raise a number of still unsolved problems justifying the active effort of research in this field and the number of publications. Taking the classical example of composites with continuous reinforcements, most materials are fabricated with non-oxide fibers, although they are mainly designed for use in oxidizing atmospheres. This apparent contradiction is related to the fact that the most performant fibers, in terms of mechanical properties, are presently the carbon and SiC-based fibers fabricated from polymer precursors, those prepared from oxide precursors being prone to grain growth and creep, even at medium temperatures. Second, CMCs with continuous fibers are tough only when the fiber/matrix bonding is not too strong and controlled during processing through a thin film of an interphase deposited on the fiber surface prior to embedding the fibers in the matrix. Presently, the best interphase materials are based on pyrocarbon or hex-BN either used as single layers or multilayers (with SiC). The fact that they are non-oxides raises again the problem of compatibility with oxidizing atmospheres. There are indeed some oxide interphases but they are much less performant than their related non-oxide counterparts. Third, CMCs are fabricated according to processes which are often lengthy, complex and costly, the best mechanical properties being achieved when processing is performed under soft conditions, i.e. low temperature and low pressure, which also means long duration. Further, because CMCS often display a complex reinforcement architecture (e.g. a multidirectional fiber architecture), the relationships that should exist between their mechanical properties and those of their elementary constituents, are not straightforward and are dependent on the processing conditions. Finally, the effect of oxidizing atmospheres on the mechanical behavior and lifetime under load for non-oxide CMCs, as well as the ways to minimize this effect, are still open questions.

The present issue of the *Journal of the European Ceramic Society* is a selection of articles based on communications which have been presented at the ECerS Conference held in Versailles, 22–26 June 1997. It covers some of the aspects of CMCs which have been briefly discussed above. We are grateful to all of those who have accepted to referee these articles and hope that this issue will be useful to readers having an interest in the field of advanced structural ceramics.

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