

Precursor-Derived Ceramics

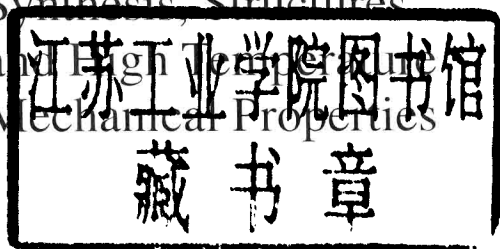
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Precursor-Derived Ceramics

Synthesis, Structures
and High Temperature
Mechanical Properties



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Preface

The preparation of inorganic materials by thermolysis of preceramic compounds has gained substantial interest during recent years. The general idea of this process route is that elementorganic precursor molecules already contain structural units of the residual inorganics formed by thermolysis, thus providing novel paths of controlling composition, atomic array and microstructure of materials. Of special interest is the manufacture of amorphous or nanocrystalline covalently bonded inorganics on the basis of silicon, boron, carbon and nitrogen, revealing a potential of properties not known from conventionally prepared materials. In order to develop a sound basis for a successful use of such materials and to judge their potential for application, there is a need for profound basic research in the field of their synthesis and processing and in the characterization of their structure and properties.

It was with this intention, when in 1995 the Japanese Science and Technology Corporation (JST) and the Max-Planck-Institut für Metallforschung (MPI-MF) signed a five-year contract for the cooperation on the synthesis of nanostructured materials by precursor thermolysis and the investigation of their superplastic behavior. It is the aim of this international cooperation to combine studies of elementorganic chemistry, materials processing and materials characterization in order to tailor the microstructure and thus the properties of covalent materials. Of special interest are nano-grained materials and their mechanical properties at high temperatures and to study superplasticity and other dynamic grain boundary phenomena. This cooperation is the most recent item in a long lasting and fruitful cooperation of the Max-Planck-Institut für Metallforschung and its representatives together with Japanese scientists and institutions active in materials research. In the light of this cooperation an international workshop on *Grain Boundary Dynamics of Precursor-Derived Covalent Ceramics* was arranged in order to present the status quo in the field of precursor-derived materials and to discuss the mid-term results in this project with the worldwide leading scientists in this research field.

As directors of this cooperation project on the German and Japanese side respectively, we would like to take the opportunity to thank the Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. and the Japanese Science and Technology Corporation for their generous support of the joint research program. We also would like to thank all the scientists who participated in the workshop for their contributions to the scientific presentations and discussions. We would like to express our special thanks to Dr. W. Hasenclever, former Secretary General of the Max-Planck-Gesellschaft, Dr. J. Roemer-Mähler (Bundesministerium für Bildung, Forschung und Technologie, BMBF) and Professor Dr. Dr. h.c. mult. Günter Petzow, Emeritus of the

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I. Globalisation of Research

Research between Nationality and Internationality

Dr. Wolfgang Hasenclever
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Globalization of research is the title, which the organizers of this workshop have given to this morning's opening session. Globalization has become a very fashionable term:

- globalization of production,
- globalization of learning,
- globalization of trade, of criminality, of pollution, of communication etc. etc.

And this morning we are to discuss globalization of research! Globalization of research, is this really a controversial issue? Hasn't research, hasn't science, used in the German sense of „Wissenschaft“ i.e. including social sciences and humanities - hasn't research always been universal, global, international? Is there really any room for making it so, to universalize, to globalize, to internationalize research? The spontaneous answers of most of us will be negative!

And yet, the relationship between national, regional, transnational, multinational, universal research has been a subject of discussion for quite a time, not only among politicians or in the media, also among scientists. Globalization is just a new, a fashionable word which draws our attention to the fact that new, modern means of transportation and communication give a new intensity, a new quality to the well-known worldwide interaction among people and institutions of research - normally regardless of borders and without reference to expectations of particular loyalties for political, institutional or economic reasons.

But research is - like most if not all human activities - a social phenomenon, i.e. something that happens not in the famous isolated ivory tower, but in interaction with its environment. Pure thought, of course, the creative process, knowledge as such might have little social relevance, is neither national nor international. Research, however, is quick to transcend its bounds of utter intellectuality and individuality. Research takes place within a social context. It is conducted by individuals, but it occurs on the basis of knowledge that has been acquired and passed on by others. Science is communication, it needs collaboration and discussions with others. Knowledge transfer, competition, application of research results, also the contrary: the dissemination restrictions by patents or for military reasons reveal the societal context of research.

Research as a social phenomenon is not only exchanging information with its environment, it also needs encouragement, support and protection by the society. Research, at least research in the 20th century, depends on favorable institutional structures, on appropriate labs, big facilities, a good educational system etc., i.e. it depends on access to resources and research activities need legal boundary conditions

and arbitration in case of conflict with the interests, goods, values of individuals or of the general public surrounding the research activity.

With respect to these interactions of research with its social environment it is only natural and justified to distinguish between national and international and to discuss the consequences of shifting responsibilities and addressing expectations from one community to another.

This is not a theoretical question and we are not free to choose one or the other option. The trend to more internationalization and globalization is irreversible, is a fact. It is obvious for industry as a result of hardly controllable market forces.

Globalization of industry research, the subject of the next presentation, is confirmed by relevant statistics (of Physics World 10/96:

"Germany looks abroad

Since 1990, German companies have increased their investments in R&D by 50% - in overseas R&D, that is. But domestic investment has declined rapidly from 2.1% of the gross domestic product in 1989 to 1.5% in 1995. Over the last five years, more than 30000 jobs in R&D have been cut or moved abroad, and about 32000 scientists and engineers are unemployed. 15% of R&D spending by German companies now goes overseas, most of it to the US."

But coming back to the field of non application oriented, of curiosity driven research it has always been understood, that it is only quality of results, that it is only the world wide recognition of the validity of results that count.

- In so far so-called fundamental research has always been international and global. The international and global character of fundamental research is not controversial, and when I have been invited by Professor Aldinger to talk to you this morning on Research between nationality and internationality he wanted me to report on a pertinent discussion in Germany which centers around the question whether the reality, the way in which nationality and internationality of research correlate today is the best reality possible. The Max-Planck-Gesellschaft dedicated two 2.5 days long colloquia here at Ringberg Castle to this issue. In 1995 MPG invited representatives of its most important partners in the very pluralistic landscape of the German system of research institutions and research supporting agencies:
- representatives of the Hermann von Helmholtz-Gemeinschaft deutscher Forschungszentren HGF the association of the big national labs working in the field of new energies, health, environment etc.,