

## FOREWORD

The beneficial impact of the European Communities involvement in scientific research and technology is wide-ranging and pervasive. There are high hopes of major advances in scientific knowledge and technological processes, while the emergence of a genuine tradition of collaborative research holds out great and continuing promise for the future. Close, frequent and long-term cooperation between universities, research centres and industry is already generating new synergies, forging a truly European scientific community. Many of tomorrow's industrial developments, destined to be determinant for our economic success and prosperity, will spring from this research.

The **Concerted European Action on Magnets - CEAM** - project is a prime example of collaborative research and development. Financed from the Communities STIMULATION action and implemented with the help of EURAM, the advanced materials programme, CEAM will bestow great benefits on European industrial competitiveness, providing a channel for high quality basic research to find its way into commercial products.

This remarkable cooperative enterprise brought together 58 laboratories and more than 120 scientists and engineers in a sustained thirty month effort. It spanned every aspect of new iron-based high performance magnets - from theoretical modelling of their intrinsic magnetic properties to the design and construction of novel electrical devices and machines.

Besides adding a new European dimension to advanced magnetic technology, CEAM also ensured that a whole new generation of young researchers and technicians have been trained in applied magnetism.

CEAM's real successes, the way in which very diverse interdisciplinary skills and expertise were marshalled across frontiers and united in a joint endeavour, represent a fine example of what Europe can achieve with realistic goals and determination. The story of CEAM, of which CODEST, the European Committee on Science and Technology, is proud, will serve in the future as a benchmark by which other projects can be judged.

Professor Umberto Colombo  
ENEA, Rome

### 3. THE PROJECT:- CONCERTED EUROPEAN ACTION ON MAGNETS

CEAM associated 58 institutes throughout Europe - including, most of the laboratories with special expertise in rare-earth iron permanent magnets. A full list of the participating groups is given in Appendix .ii.

The project received funding of 2.5 million ECU. for a programme of research covering a period of 30 months. Industrial companies made up about one third of the group with the others coming from universities and national laboratories. Figure 2. indicates the breakdown by country and type of organisation.

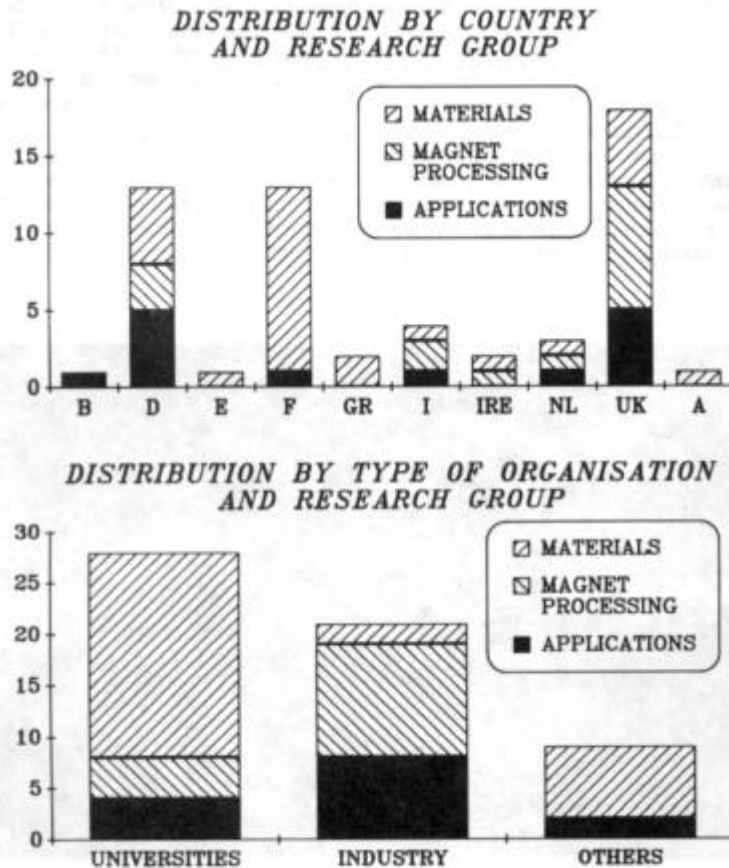


Figure 2.a) Distribution by Country  
b) Distribution by Type of Organisation

#### 4. AIMS AND OBJECTIVES

Participation in CEAM was open to laboratories which had an active interest in the field and which wished to join the project when it was first established.

The primary aims were:

- o to develop high performance iron-based rare earth permanent magnets and to design novel devices which exploit their exceptional properties;
- o to generate European collaboration by the exchange of scientists and stimulate a new generation of researchers to undertake projects in applied magnetism of industrial relevance;
- o to provide a skills and information base to permit European industry to exploit the advanced magnets effectively.

#### 5. ORGANISATIONAL ASPECTS

The research programme was divided into the three broad areas of:

- \* MATERIALS
- \* MAGNET PROCESSING
- \* APPLICATIONS

The **MATERIALS** group was composed largely of physicists and chemists working on phase diagrams, searching for new alloys and examining the intrinsic and extrinsic magnetic properties of rare earth alloys with particular reference to those with the  $\text{Nd}_2\text{Fe}_{14}\text{B}$  structure.

The **MAGNET PROCESSING** group mainly involved metallurgists and materials scientists and included significant industrial participation. They were primarily concerned with the microstructure of magnet alloys and the numerous problems of magnet processing and stability.

The third group on **APPLICATIONS** focussed on both electromagnetic and magnetostatic applications of the new magnets. Many of the participants in this group were electrical engineers and specialists in computer-aided design (CAD) working in industrial companies and universities.

Regular bi-annual meetings were held at different locations throughout the project life and consolidated technical progress reports were prepared on a six-monthly basis for the Commission. Close and continuous liaison with the scientific project manager in Brussels was maintained at all times.

Table 1. Summary of Contractors participating in CEAM

CONTRACT No.	ORGANISATION	PLACE	NAME	PARTICIPATION
<b>MATERIALS</b>				
*****				
1.01	Centre Nat. de la Recherche Scientifique	Grenoble	D. Givord	Co-ordinator
1.02	Universite de Savoie	Annecy	J.M. Moreau	
1.03	Fulmer Research Institute	Slough	R.I. Saunderson	Partial
1.04	Vacuumschmelze GmbH	Hanau	W. Rodewald	
1.05	Centre d'Etudes Nucleaires de Grenoble	Grenoble	R. Chamberod	
1.06	Universite de Bordeaux	Talence	J. Etourneau	
1.07	Institut National Polytechnique	St. Martin d'Heres	C. Allibert	
1.08 a	Universite Grenoble I	St. Martin d'Heres	U. Berthier	
1.08 b	Universite Grenoble I	St. Martin d'Heres	F. Hartmann-Boutron	
1.09	Centre Nat. de la Recherche Scientifique	Grenoble	D. Fruchart	
1.10	Centre de Recherches Nucleaires	Strasbourg	J.P. Sanchez	
1.11	Centre d'Etudes Nucleaires de Grenoble	Grenoble	M. Boge	
1.12	Institut National Polytechnique	St. Martin d'Heres	R. Fruchart	
1.13	University of Zaragoza	Zaragoza	J. Bartolome	
1.14	Centre d'Etudes Nucleaires de Grenoble	Grenoble	R. Gillet	
1.21	Trinity College Dublin	Dublin	J.M.D.Coe	Co-ordinator
1.22	University of Amsterdam	Amsterdam	J.M.M Franse	
1.23	Kerforschungszentrum Karlsruhe	Karlsruhe	G. Czjzek	
1.24	University of Parma	Parma	G. Asti	
1.25	Ruhr Universitaet Bochum	Bochum	M. Rosenberg	
1.26	Philips Research Laboratories	Eindhoven	K.H.J Buschow	
1.27	University of Durham	Durham	W.D. Corner	
1.28	Nuclear Research Centre "Demokritos"	Attiki	A. Kostikas	
1.29 a	Max-Planck Inst. f. Metaiforschung	Stuttgart	E.T. Henig	
1.29 b	Max-Planck Inst. f. Metaiforschung	Stuttgart	H. Kronmuller	
1.30	University of Salford	Salford	P.J. Grundy	
1.31	University of Birmingham	Birmingham	S. Abell	
1.33	Imperial College London	London	D.G. Pettifor	
1.34	University of Crete	Crete	G.C. Hadjipanayis	
1.35	Technische Universitaet Wien	Vienna	H.R. Kirchmayr	
1.36	Universitaet Giessen	Giessen	C. Heiden	
<b>MAGNET PROCESSING</b>				
*****				
2.01	University of Birmingham	Birmingham	I.R. Harris	Co-ordinator
2.02	University of Sheffield	Sheffield	H.A. Davies	
2.03	SG Magnets Ltd.	Rainham	A.J. Ward	
2.04	Rare Earth Products Ltd	Widnes	D. Kennedy	
2.05	Gesellschaft f. Elektrometallurgie	Wuernberg	S. Sattlerberger	
2.06	Industria Ossidi Sinterizzati SpA	Malgesso	A. Cartocetti	Partial
2.07	Mullard Southport Ltd	Southport	E. Rozendaal	
2.08	Sunderland Polytechnic	Sunderland	A.G. Clegg	
2.09	Lucas Engineering and Systems Ltd.	Solihull	M. Ward	
2.10	General Electric Co.	Wembley	J.M. Vincent	
2.11	Trinity College Dublin	Dublin	J.M.D.Coe	
2.12	Krupp Widia GmbH	Essen	W. Ervens	Partial
2.13	Thyssen Edlestahlwerke AG	Dortmund	H. Nagel	
2.14	Ing. C. Olivetti SpA	Ivrea	S. Tori	