

EUR 10.891

**INVENTORY OF
ON-GOING HIGH TEMPERATURE
MATERIALS RESEARCH ACTIVITIES
IN EUROPE**

**SECTION 4:
ALLOY PRODUCTION and PROCESSING**

COMMISSION OF THE EUROPEAN COMMUNITIES
Joint Research Centre, Petten Establishment
High Temperature Materials Information Centre



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Commission of the European Communities

Physical Sciences

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ON-GOING HIGH TEMPERATURE
MATERIALS RESEARCH ACTIVITIES
IN EUROPE**

**SECTION 4:
ALLOY PRODUCTION AND PROCESSING**

Coordination: M. de Groot

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**Directorate-General
Science, Research and Development**

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Fig. 1 Frequency analysis of Materials Applications/Technologies

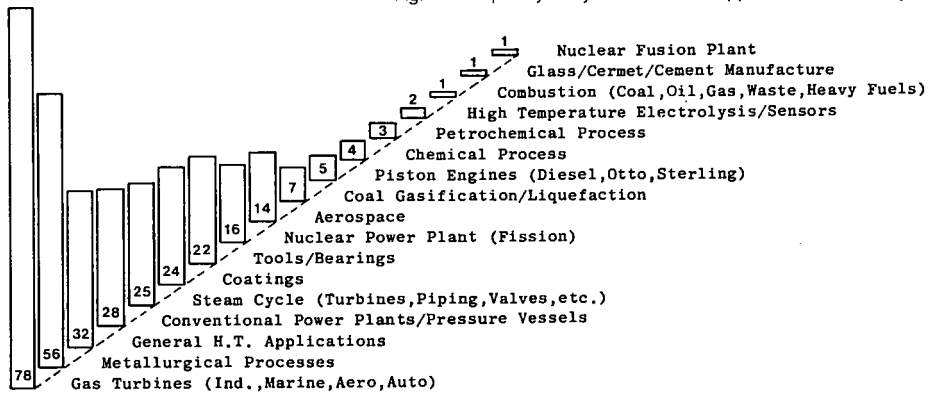


Fig. 2 Frequency analysis of type of Materials

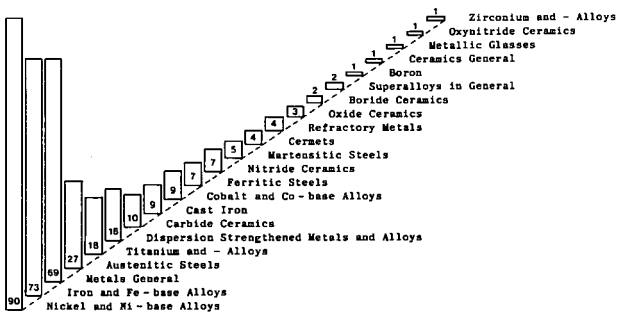
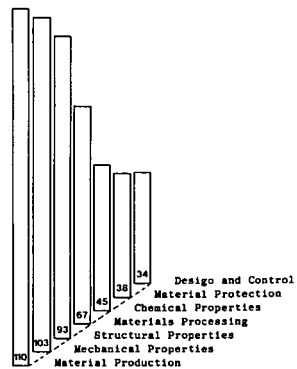


Fig. 3 Frequency analysis of type of Research Topics



Legend

Inventory of Organisations, Scientists and On-Going Research Projects:

- AUSTRIA
- BELGIUM
- DENMARK
- FINLAND
- FRANCE
- F.R. GERMANY
- IRELAND
- ITALY
- THE NETHERLANDS
- SWEDEN
- SWITZERLAND
- UNITED KINGDOM

Index of Materials Applications/Technologies

Index to Type of Material

Index to Type of Research Topic

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Preface

In the frame of the High Temperature Materials (HTM) Programme of the Commission of the European Communities, carried out at the JRC, Petten Establishment, an Inventory of HTM research in Europe is being established. Inventories facilitate identification of areas where cooperation should be promoted and additional R & D actions be stimulated.

The present volume contains the fourth of the Inventory, devoted to Alloy Production and Processing. Section 1: HTM-Corrosion, Section 2: Mechanical Properties and Section 3: Ceramics*) are already published and are available upon request.

This section comprises information obtained by means of an inquiry carried out in 1986, and by personal communication.

It lists on-going research projects with indication of the performing organisations and the names of the scientists involved in this research.

The list is arranged in alphabetic order per country and organisation. Replies in languages other than English have been translated.

Access to specific research activities is facilitated by indexing per type of materials application/technology, type of material, type of research topic and the involved scientists. Histogrammes of frequencies of research activities are presented in figures 1, 2 and 3 and provides an overview over today's distribution of R & D efforts in the field.

The JRC, Petten Establishment appreciates the willing contribution of all the organisations and scientists who shared in the realisation of this third section and would welcome support for the preparation of future editions.

**) Inventory of On-Going High Temperature Materials Research Activities in Europe*

Section 1: Corrosion EUR 6919 EN

Section 2: Mechanical Properties EUR 8637 EN

Legend

This Inventory presents information on research projects, currently carried out or planned in industrial firms, universities and research organisations in Europe. The information is arranged in alphabetic order per country and organisation. Example of Organisation Listing (Entry)

SYSTEM

EXAMPLE

Country	DENMARK
Entry Number	14
Name of Organisation	Technical University of Denmark
Name of Dept./Inst.	Department of metallurgy
Address	Anker Engelundsvej 101
City	Dk-2800 Lyngby
Name(s) of scientist(s)	K. Borggreen (1,2)
Project(s)	14.1 Mechanical and high temperature properties of as – cast Hk 40 after 10.000 operating hours 14.2 Residual lifetime study of low alloyed steels Power Stations 14 Mo V63; 13 Cro Mo 44

①

Technische Universität Wien

Inst. für Allgemeine Physik
Karlsplatz 13
A-1040 Wien

P. Braun (1,3)

H. Stoeri (2,4)

PROJECT:

- 1 Quantitative analysis of metal-non metal compounds.
 - 2 Mass spectrometry analysis and modelling of plasma during coating.
 - 3 Oxygen adsorption and desorption on TiC, TaC and WC.
 - 4 Reactive ion plating.
-

2

C.R.M.

Centre de Recherche
Metallurgiques
Rue Ernest Solvay 11
B-4000 Liege

D. Coutsouradis (1-7)
A. Davin (3,6)
E. Diderrich (4,5,7)
M. Lamberigts (2,5-7)

PROJECT:

- 1 Influence of casting conditions on superalloy mechanical properties.
 - 2 Low cycle fatigue of cast superalloys.
 - 3 Aluminium-base protection coatings.
 - 4 Precision forging of superalloys.
 - 5 Silicon nitride-based ceramics.
 - 6 Metallurgical aspects of the repairing processes of gas turbine components.
 - 7 Isostatic hot pressing of cast superalloys.
-

3

SCK/CEN

Centre d'Etudes
de l'Energie Nucleaire
Boeretang 200
B-2400 Mol

L. Coheur (1-4)

PROJECT:

- 1 Development of ODS alloys for high temperature applications.
 - 2 Study of the "powder beating process" for ODS alloys fabrication.
 - 3 Injection molding of metal powders for making complex-shape parts.
 - 4 Preparation and utilization of rapidly solidified powders for making high-temperature components.
-

4

Universite Libre de Bruxelles

Metall. Physique, Cp. 194-4
Ave. F. Roosevelt 50
B-1050 Brussels

J. Charlier (1-3)
J. Diltour (2)
J. P. Elinck (3)

PROJECT:

- 1 Creep-fatigue interactions in turbine steels.
 - 2 Dynamic recrystallization of brass.
 - 3 Influence of temperature and frequency on the fatigue crack propagation.
-

5

Universite de Liege

Inst. de Physique
B-4000 Sart-Tilman

Lecomte-Beckers (1)

PROJECT:

- 1 Influence of solidification conditions on the microstructure of cast superalloys.
-



Techn. University of Denmark

Department of Metallurgy
Building 204

V. F. Buchwald (1)
K. A. Thorsen (1)

PROJECT:

- 1 Investigation of brazing of Inconels by optical hot stage microscopy.
-

7**CLECIM**

Groupe Creusot-Loire
51, Rue Sibert
B.P. 154
F-42403 Saint-Chamond Cedex

J. Pronkiewicz (1,2)

PROJECT:

- 1 Ceramic coatings for continuous casting rolls.
 - 2 Metal plating in a continuous casting mold.
-

8**E.N.S. de Chimie de Strasbourg**

Dept. Science des Materiaux
1 Rue Blaise Pascal
F-67008 Strasbourg

A. Clauss (1)

PROJECT:

- 1 Structure of interstitial solid solutions (H,N,O,C) in niobium and tantalum.
-

9**E.N.S.-Electrochimie/-Metall.**

Lab. d'Adsorption et Reaction de Gaz sur Solides
B.P. 75
F-38402 Saint Martin d'Herès

M. Caillet
A. Galerie (1-2)

PROJECT:

- 1 Ion implantation and dry corrosion.
 - 2 Laser beam lining.
-

10

Inst. Nat. Polytechnique de Grenoble L.T.P.C.M.H

Domaine Universitaire
B.P. 75
F-38402 Saint Martin d'Herès

F. Durand
M. Durand-Charre (1,2)
S. Hamar-Thibault (3)
R. Hamar (4)

PROJECT:

- 1 Superalloy phase equilibria.
 - 2 Structure of chromium containing cast irons.
 - 3 Structure of hard facing alloys.
 - 4 Model for the solidification during metal casting.
 - 5 Influence of convection on solidification.
-

11

E.N.S. des Mines de Paris

Centre des Matériaux
B.P. 87
F-91003 Evry Cedex

Y. Bienvenu (4,9)
J. P. Henon (12,13)
A. Pineau (7,10)
L. Remy (3,6,8)
J. L. Strudel (1,2,5,11)
J. P. Trottier (1-10)

PROJECT:

- 1 Alloys for single crystal turbine blades.
 - 2 Creep of alloys for single crystal turbine blades.
 - 3 Fatigue of alloys for single crystal turbine blades.
 - 4 Alloys for P/M turbine discs.
 - 5 Creep of alloys for P/M turbine discs.
 - 6 Fatigue of alloys for P/M turbine discs.
 - 7 Fatigue cracking/oxidation of IN 718.
 - 8 Short cracks propagation in high performance nickel alloys.
 - 9 Foundry recycling of nickel base superalloys.
 - 10 Harmfulness of microstructural defects in stainless steel at high temperature.
 - 11 High-temperature creep of stainless steel.
 - 12 Corrosion of gas turbine alloys.
 - 13 Gasification : corrosion behaviour of coatings applied on steel.
-

12**E.N.S des Mines de St.-Etienne**

Dept. Materiaux
158 Cours Fauriel
F-42023 Saint Etienne Cedex

P. Benaben (10)
J. H. Driver (3)
P. Goeuriot (1,2)
A. Kobylanski (6,8)
J. Le Coze (4,5)
P. Lesbats (4,9)
R. Tardy (9)
F. Thevenot (1,2)

PROJECT:

- 1 Steels and alloys boronizing.
 - 2 Cermets boronizing.
 - 3 Thermal treatments - High-temperature mechanical properties.
 - 4 New alloys: stainless, refractory alloys.
 - 5 Single crystals and bicrystals fabrication.
 - 6 Single crystals and bicrystals of refractory metals and alloys.
 - 7 High-purity steels.
 - 8 Molding of carburized high speed powder mixtures.
 - 9 Pure metals preparation.
 - 10 Hard chromium deposition or decoration (Cr III).
-

13**Universite de Limoges**

Centr. Rech. et Etude Ceram.
123, avenue A.Thomas
F-87060 Limoges Cedex

M. Billy (1,2)
F. Nardou (1,2)

PROJECT:

- 1 High-temperature stress corrosion of a refractory alloy in wet atmosphere.
 - 2 Role of growth stresses during high-temperature oxidation.
-

14

Université de Provence

Centre St. Jerome
Place Victor Hugo
F-13331 Marseille Cedex 3

D. H. Boone (3)
R. Streiff (1,2,4-7)

PROJECT:

- 1 Effect of hafnium as active element of the substrate on the oxidation resistance of protective coatings.
 - 2 Deposition and oxidation behaviour of chromaluminide coated nickel-base alloys
 - 3 Relationship between structure and hot corrosion behaviour of platinum modified aluminide coatings.
 - 4 Protection of titanium and its alloys TA6V4 by aluminide coatings.
 - 5 Investigation by acoustic emission of the oxidation of Cr,Hf and Pt modified aluminide coatings.
 - 6 Surface remelting of vacuum plasma deposited coatings.
 - 7 Hot Corrosion of aluminide coatings applied on nickel and nickel-base alloys.
-

15

Univ. des Sciences et Techn.

Lab. Physique Applique
Place Eugene Bataillon
F-34100 Montpellier

A. Boyer (1-3)

PROJECT:

- 1 High-temperature devices.
 - 2 Thermal barriers.
 - 3 High-temperature oxides.
-

16

ARBED Saarstahl GmbH

Postfach 101980
D-6620 Volklingen/Saar

K. David (1,2)
E. Kohlhaas (2)
K. Sartorius (1)

PROJECT:

- 1 Manufacturing of die forged parts for driving gear in Waspaloy by isothermal forging.
 - 2 Powder metallurgy of superalloys.
-

17

Internat. Atomreaktorbau GmbH

Abt. T25 "Werkstoffe und Chemie"
Friedrich-Ebert Strasse
D-5060 Bergisch-Gladbach 1

H. Leising (1-5)
E. Ohrt (1-5)

PROJECT:

- 1 Techniques of making high-temperature alloys for various half-finished shapes.
 - 2 Special processes of shaping.
 - 3 Influence of the shaping process on the structure and properties of halffinished products.
 - 4 Qualification of welding processes for the use of HT alloys.
 - 5 Problem adapted non-destructive testing for austenitic steels and their weldings.
-

18

Motoren und Turbinen Union

GWA 1
Dachauerstrasse 665
D-8000 Munchen 50

M. B. Borchert (3,5)
D. Froschhammer (2)
G. Koenig (3)
L. Peichl (4)
W. Track (1,6)
J. Wortmann (2,6)

PROJECT:

- 1 PM alloys.
 - 2 Turbine blade material.
 - 3 Mechanical behaviour of discs.
 - 4 Coatings for hot gas corrosion protection.
 - 5 Heat-resisting titanium alloys.
 - 6 Powder metallurgy of aluminium.
-

19

Techn. University of Aachen

Met. Huttenwesen-Elektrometall.
Intzestrass 3
D-5100 Aachen

U. Kerney (1,2)

PROJECT:

- 1 Metallurgical investigations of ternary manganese base alloys with small additions of AL, V, Ta and/or Nb.
 - 2 High-temperature corrosion of manganese base alloys.
-

20

Techn. University of Aachen

Schweisstechn. Fert. Verfahren
Pontstrasse 49
D-5100 Aachen

F. Eichhorn (1-4)

PROJECT:

- 1 Use of electron beam welding for the energy and material conservative joining of expensive materials and compounds.
 - 2 Narrow gap inert gas welding of heavy section pieces.
 - 3 Semi-automatic inert gas welding of high temperature alloys.
 - 4 Use of transistorized current sources for MIG – welding of high-temperature materials.
-

21

Techn. University of Aachen

Giesserei-Institut
Intzestrassse 5
D-5100 Aachen

W. Axmann (1)
P. R. Sahn (1)

PROJECT:

- 1 Single crystal turbine blades.
-

22

Ruhr Universitat Bochum

Inst. fur Werkstoffe II
Universitätsstrasse 150
Postfach 102148
D-4630 Bochum 1

H. Berns (1)

PROJECT:

- 1 Improvement of the toughness of hot work tool steels.
-

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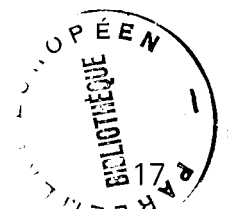
Tech. Univ. Braunschweig

Schweisstech.-Werkstofftechn.
Pockelstrasse 14
D-3300 Braunschweig

W. Kohler (2)
K. T. Rie (1,2)
R. M. Schmidt (1)
R. Schubert (1)

PROJECT:

- 1 Influence of welding defects at high temperature on the high-temperature LCF lifetime.
 - 2 Influence of exposure to process gases on the lifetime of modified Ni-based alloys subjected to low cycle fatigue.
-



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Techn. University of Darmstadt

Inst. für Werkstoffkunde
Grafenstrasse 2
D-6100 Darmstadt

J. Granacher (1-12)
K. H. Kloos (1-12)

PROJECT:

- 1 Creep and rupture behaviour of heat resisting steels under non stationary stress conditions.
 - 2 Cyclic material behaviour during longterm exposure to variable tensile stresses at high temperature simulating the working conditions.
 - 3 Crack initiation and growth in forged heat resisting materials submitted to stress rupture conditions.
 - 4 Determination of creep laws and criterions for crack initiation and crack growth for parts submitted to creep using the finite elements method.
 - 5 Influence of test specimen location, shape and dimensions on the stress rupture behaviour of an austenitic weld.
 - 6 Long-term creep behaviour of heat resisting gas turbine materials under constant and changing stress conditions.
 - 7 Long-term effect of surface protective devices on the stress rupture behaviour of nickel-base superalloys.
 - 8 Behaviour of gas turbine blade materials subjected to mechanical stresses and hot gas corrosion for a long time.
 - 9 Investigation and description of the creep behaviour of heat resisting steels
 - 10 Stress rupture behaviour of heat resisting steels submitted to intermittent cyclic or non-cyclic stresses.
 - 11 Defect accumulation during long-term exposure to alternating tensile stresses at high temperature simulating working conditions.
 - 12 High-temperature behaviour and stress corrosion behaviour of selected heat resisting nickel alloys for turbine parts subjected to creep.
-

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Techn. Universität München

Lehrst. für Metallurgie und Metallkunde
Arcisstrasse 21
D-8000 München 2

Kh. G. Schmitt-Thomas (1,2)

PROJECT:

- 1 Thermal barrier coatings for superalloys.
 - 2 Inertia welding of high-temperature materials.
-

26**Universität Munster**

Inst. für Metallforschung
Domagkstrasse 75
D-4400 Munster
E. Nembach (1)

PROJECT:

- 1 γ' hardening in the NIMONIC alloy PE16.
-

27**Universität Stuttgart**

IKE
Pfaffenwaldring 31
Postfach 801140
D-7000 Stuttgart 80

H. G. Mayer (2-4)

G. Neuer (1)

PROJECT:

- 1 Contactless temperature measurement during hot rolling.
 - 2 Preparation and properties of wear resistant coatings by electron beam welding or diffusion bonding.
 - 3 Joining of ODS-alloys (COST 501) by EB welding, diffusion bonding and HT brazing.
 - 4 Solid state diffusion bonding of P/M and cast superalloys for gas turbines (COST 50-III)
-

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Materials Research Centre

Nat. Inst. for High. Ed. Limerick
Plassey Techn. Park
Castletroy Limerick

J. D. Bolton (1)
A. Healey (2)
E. R. Petty

PROJECT:

- 1 Replacement of nickel by manganese in stainless, maraging and heat resistant steels.
 - 2 Welding/solidification characteristics of manganese-substituted nickel containing alloy steels.
-

29**C.N.R. Ist. Tecnologia**

dei Materiali Metallici non Tradizionali
Via Induno 10
I-20092 Cinisello Balsamo-Mi

F. Gabrielli (2)
V. Lupinc (3)
M. Marchionni (1,5)
A. Marucco (4)
B. Vicentini (1-5)

PROJECT:

- 1 High-temperature time dependent fatigue of nickel base superalloys in different environments.
 - 2 High-temperature fatigue and creep crack growth in nickel-base superalloys.
 - 3 High-temperature creep, aging, regeneration and fracture of IN 939 and Udimet 720.
 - 4 Structural transformations and ordering formation kinetics in Ni-Fe-Cr alloy.
 - 5 Austenitic stainless steels for fast reactor use.
-

30**Nuova Sias Societa Italiana**

Stabilimento di Aosta
via Paravera 16
I 11100HAosta

R. Gubiotti
E. Nocerino (2)
G. Sapegno (1)

PROJECT:

- 1 Development of new austenitic steel valves with improved operating properties.
 - 2 Development of a new Fe-base superalloy for heavy duty engine exhaust-valves.
-

31**Universita di Padova**

Ist. di Chimica Industriale
Via Marzolo 9
I-35100 Padova
M. Magrini (1)
E. Ramous (2)

PROJECT:

- 1 Study of microstructural modification in alloys during high temperature service.
 - 2 Applications of coatings on high temperature alloys by laser.
-

32

N.V. Kema Div. WSK – Dept. SBA

Utrechtseweg 310
NL-6812 AR Arnhem

W. Huijbregts (1)

PROJECT:

- 1 Subphidation-Constant extension rate.
-

33

University of Groningen

Dept. Appl. Physics
Nyenborg 18
NL-9747 AG Groningen

J. Th. M. De Hosson (1-5)

PROJECT:

- 1 Dislocation-precipitate interaction in Ni-Cu-Al alloys.
 - 2 TEM observations of MA 6000 superalloys.
 - 3 Lattice defects in high temperature low cycle fatigue behaviour of PM – astroloy.
 - 4 Field ion microscopy of Ni-base superalloys.
 - 5 Dislocations in materials for tribotechnical applications.
-

34**Swedish Inst. Metals Research**

Dept. of Struct. Metallurg
Drottning Kristinas Vag 48
S-11428 Stockholm

G. Engberg 1-4,6-9
B. G. Ivarsson (5,10)
R. Sandstrom (1,2)

PROJECT:

- 1 Residual lifetime.
 - 2 Stress relief heat treatments (weld,cold deformation).
 - 3 Thermal fatigue.
 - 4 Crack propagation during thermal fatigue.
 - 5 Creep in buttwelded tubes.
 - 6 Interaction creep-fatigue.
 - 7 Creep properties of PM-materials.
 - 8 Creep properties of Cu-Zr alloys.
 - 9 Creep and hot corrosion of an austenitic stainless steel with REM additions.
 - 10 Extrapolation of creep data.
-

35**Chalmers University of Techn.**

Dept. of Engineering Metals
S-40296 Goteborg

R. Warren (1)

PROJECT:

- 1 Effects of powder characteristics and post-HIP heat treatment on the microstructure of PM-superalloys.
-

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Eidgenossische T.H. Zurich

Inst. für Metallurgie
ETH Zentrum
CH-8092 Zurich

M. O. Speidel (1,2)

PROJECT:

- 1 Modified 12% Cr-steels for high-temperature service.
 - 2 High-temperature materials: resistance to crack growth.
-

37**Centr. Electr. Generating Board**

Marchwood Engineering Labs.
Welding Section
S04 4ZB Southampton

D. J. Allen (1,2)
B. Chew (5)
J. N. Clark (3,4)
D. Denby* (2)
J. A. Lambert (1)
J. Myers (4,6)
R. D. Nicholson
A. M. Stansfield* (2)
D. A. Wolstenholme (1)
A. R. Wooldridge* (2)

PROJECT:

- 1 Solidification cracking in welds.
 - 2 Influence of weld-deposited cladding on ultrasonic inspection of pressure vessels. (together with CEGB NDT-applications Centre Wythenshawe Manchester*)
 - 3 Welding of Cr Mo V steels.
 - 4 Welding of ESSHETE 1250.
 - 5 Transformation behaviour of 9CrMo.
 - 6 Composition of 316 stainless steel welds
-

38**IMI Titanium Limited**

Research Department
P.O. Box 704
B6 7UR Witton

P. A. Blenkinsop (1-4)
M. W. Kearns (2-4)
B. W. H. Lowe (4)
D. F. Neal (1)

PROJECT:

- 1 Development of high temperature titanium alloys.
 - 2 Oxidation resistance of titanium alloys.
 - 3 Powder metallurgy.
 - 4 Near to net shape developments including SPF, castings, extrusion.
-

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University College Cardiff

Metallurgy – Mat. Science
Newport Road
CF2 1TA Cardiff

R. D. Jones (1)
R. D. Walker (1)

PROJECT:

- 1 High temperature oxidation characteristics of some grades of hot-dip aluminised steel.
-

40

University of Leeds

Dept. of Metallurgy
LS2 9JT Leeds

A. J. Baker (6)
A. N. Bramley (2)
C. Hammond (7)
T. A. Hughes (2)
J. Nutting (3-6)
G. Pollard (1)

PROJECT:

- 1 The evolution of microstructure in a mechanically alloyed nickel base superalloy.
 - 2 Quantification of microstructure in superalloy forgings.
 - 3 Sulphidation resistance of alloy steels.
 - 4 The role of sulphides in influencing the mechanical properties of alloy steels used for turbine forgings.
 - 5 Structure property relationships in 2%Cr Mo steels.
 - 6 Mechanisms of cavitation in creep resisting steels.
 - 7 Superplasticity and microstructure in titanium base alloys.
-

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University of London

Imperial College
Dept. of Metall. and Mat. Science
SW7 2BP London

M. G. Hocking (1-2)
P. S. Sidky (1)
V. Vasantasvree (2)

PROJECT:

- 1 Production and corrosion testing of iron base alloys.
 - 2 Production and hot corrosion testing of coatings.
-

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Univ. of Techn. Loughborough

Dept. of Mat. Eng. and Design
LE11 3TU Loughborough

T. E. Chung (6)
R. G. Faulkner (1-9)

PROJECT:

- 1 Quantitative microstructural studies of experimental single crystal blade alloys.
 - 2 Effect of hafnium on phase stability and mechanical properties of virgin + revert MAR M 002.
 - 3 Chromium oxide formation on advanced boiler type materials.
 - 4 Long term metallurgical stability of aero engine materials.
 - 5 High temperature fracture in Fe-12 Cr steels.
 - 6 Creep-fatigue interactions at 350 C-550C in 316 steels.
 - 7 Segregation in steels.
 - 8 Partitioning effects in single crystal alloys.
 - 9 Chromium diffusion in advanced boiler tube alloys.
-

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University of Manchester

Dept. of Metallurgy
Metallurgy Building
Grosvenorstreet
M1 7HS Manchester

N. Ridley (1-6)

PROJECT:

- 1 Superplastic deformation characteristics of titanium alloys.
 - 2 Diffusion bonding of superplastic alloys
 - 3 Superplastic deformation of aluminium alloys.
 - 4 Superplastic deformation of duplex stainless steels.
 - 5 Superplastic forming and diffusion bonding.
 - 6 Superplastic deformation characteristics of aluminium-lithium alloys.
-

44

Crystallography Laboratory

Dept. of Metallurgy & Eng.
Materials
The University
NE1 7RU Newcastle upon Tyne

A. Hendry (1,4)
K. H. Jack (2,3)

PROJECT:

- 1 High-strength stainless steel wire.
 - 2 New hard metals.
 - 3 Nitrogen steels.
 - 4 Characterization of industrial nitriding processes.
-

45

University of Nottingham

Dept. of Mechanical Engineering
University Park
NG7 2RD HNottingham

T. H. Hyde (1-3)
J. J. Webster (2,3)

PROJECT:

- 1 Plasticity/creep interactions in 316 stainless steel.
 - 2 Development and application of finite element programs for predicting ratchetting and creep of components subjected to steady and variable mechanical loads.
 - 3 Development and application of finite element programs for predicting crack growth rates under elastic-plastic-creep conditions.
-

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University of Oxford

Metallurgy and Science of Mat.
Parks Road
OX1 3PH Oxford

B. Cantor (1)
G. D. W. Smith (1)

PROJECT:

- 1 Rapidly solidified nickel alloys.
-

47

University of Sheffield

Dept. of Metallurgy
Mappin Street
S1 3JD Sheffield

H. A. Davies (1,2)
G. W. Greenwood (6,8,11)
C. W. Harowth (10)
H. Jones (6)
D. H. Kirkwood (3)
C. M. Sellers (4,5)
D. H. Warrington (2)
J. A. Whiteman (7,9)

PROJECT:

- 1 Rapid quenching of superalloy strip.
 - 2 Nickel-based superalloy brazing strip.
 - 3 Splat-quenched tool steels.
 - 4 Deformation of stainless steels.
 - 5 Hot working of nickel-based superalloys.
 - 6 Structure, creep and fracture of austenitic steels.
 - 7 Carbides in tool steels with Niobium.
 - 8 Precipitation and recrystallization of austenitic steels.
 - 9 Changes in carbides in ferritic steels.
 - 10 Ternary diffusion + interface morphology.
 - 11 Cavity growth and shrinkage in superalloys.
-

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University of Strathclyde

Dept. of Mechanics of Materials
Weir Bldg
Montrose street
G1 1XJ Glasgow

J. Spence (1)

PROJECT:

- 1 Influence of manufacturing process on materials properties of straight and curved tubes.
-

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University College of Swansea

Dept. of Metall. and Mat. Techn.
Singleton Park
SA2 8PP Swansea

R. W. Evans (1-8)

B. Wilshire (1-8)

PROJECT:

- 1 Creep life prediction of welded structures.
 - 2 Creep life prediction of silicon nitride ceramic components.
 - 3 Numerical modelling of superalloy forging.
 - 4 Optimization of superalloy disc microstructures.
 - 5 Numerical modelling of hot rolling.
 - 6 Forging procedures for titanium alloy compressor blades.
 - 7 Lining of cast MAR-M002 turbine blades.
 - 8 The development of remanent life procedures.
-

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Comm. of the Europ. Communities

DG XII – COST 501-503-504-505

Rue de la Loi, 200
B-1049 Bruxelles

O. Morocutti

PROJECT: COST 501

- 1 Development of corrosion and erosion resistant valve materials for coal conversion systems.
(E. Kny Metallwerk Plansee GmbH Reutte Austria)
- 2 Development of a high strength, high corrosion resistant ODS superalloy.
(L. Coheur CEEN Mol Belgium)
- 3 Development of an ODS ferritic alloy for applications at high temperatures.
(L. Coheur CEEN Mol Belgium)
- 4 Development and applications of 9-12% Cr steels at 550 C-620 C.
(B. Walzer Gebr. Sulzer AG Winterthur Switzerland)
- 5 Development of a spheroidal heat resisting cast iron for applications at 450 C-550 C.
(H. Lindscheid Gebr. Sulzer AG Winterthur Switzerland)
- 6 Modified 12% Cr-steels for high temperature service.
(M. Speidel ETH Zurich Switzerland)
- 7 Development and applications of 9-12 Cr steels at 550 C-620 C.
(A. Trautwein G. Fischer AG Schaffhausen Switzerland)
- 8 Preparation and testing of protective coatings for improving the HT corrosion resistance of dispersion strengthened superalloys.
(P. Huber Gebr. Salzer AG Winterthur CH)
- 9 Development of better and more economic materials for exhaust valves for large diesel engines.
(Burggraf Maerkisches Werk Halver D)

- 10 Development of metallurgically bonded bimetallic tubes with special emphasis on their use for vaste heat boilers in coal gasification plants and fluidised bed combustion.
(H. ichter VDM Duisburg)
- 11 Directional solidification of cooled industrial gas turbine blades.
(A. Donner Thyssen Giesserei AG Bochem D)
- 12 Optimization of high temperature oxidation resistant ODS materials.
(D. Hedrich Daimler-Benz AG Stuttgart D)
- 13 Mechanical properties, corrosion behaviour and metallurgical stability of brazed and diffusion bonded ODS superalloys MA 6000 and MA754.
(B. Jahnke Brown Boveri & Cie Heidelberg D)
- 14 Joining of oxide dispersion strengthened alloys by electron beam welding, diffusion bonding and furnace brazing.
(H. Mayer Inst. fuer Kerntechnik & Energie Stuttgart D)
- 15 Development of spheroidal cast iron for high temperature service in turbine casing.
(K. Keienburg Kraftwerk Union AG Muelheim D)
- 16 ODS-superalloys: processing behaviour in joining, electro-chemical machining and coating; evaluation of material properties.
(P. Adam MTU Muenchen GmbH D)
- 17 Improvement to the cleanliness and of the reliability of powder metallurgical superalloys.
(J. Davidson Imphy S.A. Imphy F + J.Strudel Y
Bienvenu Armines + Y. Honnorat Shecma F)
- 18 Development of amorphous or microcrystal line metals for brazing high temperature Ni-base alloys.
(Y. Honnorat Snecma Evry F + W. Wadie Impy S.A.F.)
- 19 Fabrication of Al rich austenitic alloys from powders.
(J. H. Davidson Imphy S.A.F)
- 20 Investigation on materials and processing methods to achieve satisfactory LCF and crack propagation in integrally cast rotors for small turboengines.
(G. Jervolino Alfa Romeo Avio Spa)
- 21 Rejuvenation of hot section gas turbine blades by hiping.
(M. H. Haafkens Interturbines Holland B.V. Lomm NL)
- 22 Effect of powder characteristics and post-HIP heat treatment on the microstructure of PM superalloys.
(R. Warren Chalmers Univ. Gotenborg S)
- 23 Optimization of alloys suitable for deliberate pre-oxidation coatings.
(T. Andersson Sandvik AB Sandviken S)

PROJECT: COST 503

- 1 Preparation of complex PM-iron parts by joining methods and evaluation of the mechanical properties of the joints.
(G. Korb Metallwerk Plansee GmbH Reutte A)

- 2 Preparation of high class Ti-parts by powder metallurgical techniques eg. special blending densification methods.
(G. Korb Metallwerk Plansee GmbH Reutte A)
- 3 Preparation and evaluation of PM composite materials for application as wear resistant components.
(O. Pacher Edelstahlwerke AG Kapfenberg A)
- 4 Effect of trace elements on metallurgical and microstructural features of sintered and deformed heavy metals.
(B. Lux Techn. Univ. Vienna A)
- 5 Process development for rapid solidification of titanium alloy powders by inert gas atomization.
(R. Ruthardt Leybold-Heraeus GmbH Hanau D)
- 6 High performance P/M Al alloys produced via extrusion.
(G. Hoellrigl Aluisse Res. Inst. Neuhausen CH)
- 7 Production of new powder metallurgical high speed steel bars.
(A. Choudhury Arbed Saarstahl Voelklingen D)
- 8 Development of joining techniques for complex parts of sintered ferrous alloys and evaluation of their strength.
(R. Schaefer Industrieanlagen Betriebsgesellschaft mbH Ottenbrunn D)
- 9 Hot isostatic pressing of highly corrosion resistant P/M alloys.
(R. Heinz Seilstorfer GmbH & Co Haag-Winden D)
- 10 Hot isostatic pressing highly corrosion resistant P/M alloys.
(W. Scharfenberger Industrieanlagen Betriebsgesellschaft mbH Ottobrunn D)
- 11 Densification of boron at relatively low temperatures by hot pressing and hot isostatic pressing.
(H. Goelfnitz Hilti EntwicklungsGes. Munchen D)
- 12 Development of an envelope for compacts suitable for hot isostatic pressing (HIP)
(H. Weiss Fraunhofer-Gesellschaft Munchen D)
- 13 Preparation of complex and multifunctional sintered steel parts by joining two or more different PM parts. Evaluation of mechanical properties of the joints.
(R. Wilfried Sinterstahl GmbH Fussen D)
- 14 Powder metallurgical production of near net shape parts of high speed steel by direct sintering.
(A. Choudhury Arbed Saarstahl Volkingen D)
- 15 Preparation of sintered, wear resistant parts by joining and evaluation of their properties.
(D. Pohl Schwaebische Huettenwerke Aalen D)
- 16 Preparation and evaluation of P/M composite materials for application as wear resistant components.
(H. Konvieka Seilstorfer GmbH & Co Haag-Winden D)
- 17 Influence of inclusions on the mechanical properties of powder metallurgical products.
(J. M. Capus QIT Fer et Titane GmbH Frankfurt D)
- 18 Process development for rapid solidification of Al alloy powders by inert gas atomization.
(R. Ruthardt Leybold-Heraeus GmbH Hanau D)

- 19 Inclusions influence on the mechanical properties in powder metallurgical products.
(O. Kraemer Techn. Inst. of Denmark Taastrup DK)
- 20 Quality examination of powder metallurgical products by use of non-destructive control methods.
(O. Kraemer Techn. Inst. of Denmark Taastrup DK)
- 21 Heating of powder compacts.
(O. Grinder Swedisch Inst. for Metals Research Stockholm S)
- 22 Densification of fine grained boron carbide by hot isostatic pressing.
(J. Adlerborn ASEA Cerama AB Robertfors S)
- 23 Mechanical alloying of powder materials.
(S. Ciyens Jydsck Techn. Inst. Aarhus DK)
- 24 Production of extra hard carbide tips which can be conveniently fixed on tools and machined.
(J. Philippe Cerametal Sarl L)
- 25 Influence of the Sinter-HIP (Sinter-Hot isostatic pressing) process on the properties of hard metals.
(J. Philippe Cerametal Sarl L)
- 26 Hot isostatic pressing of highly corrosion resistant PM alloys.
(C. Aslung Nyby Uddelholm Powder AB Torshalla S)
- 27 Production and assessment of rapidly solidified high temperature aluminium alloys.
(L. Arnberg Swedisch Inst. for Metals Research Stockholm S)
- 28 The use of powder metallurgy for load bearing applications such as gears.
(M. Stroemgren Horganos AB Horganos S)
- 29 Preparation and characterization of WC and cemented carbide powders for hard metal production.
(A. Taskinen Inst. Process Metallurgy Helsinki SF)
- 30 Development of activated steel powders for tough fatigue resistant sintered components.
(J. Barnby Univ. of Aston Birmingham U.K.)
- 31 Development of high toughness fatigue resistant pressed and sintered steels.
(J. Barnby Univ. of Aston Birmingham U.K.)
- 32 The development of high density, high performance sintered powder metal components using hot isostatic pressing.
(B. Rickinson HIP (Powder Metals) Ltd. Chesterfield U.K.)
- 33 Material development and fatigue design of PM-connecting rods of sintered steels
(B. Dabell GKN Technology Ltd. Wolverhampton U.K.)
- 34 The use of powder metallurgy for load bearing applications such as gears.
(S. Hill GKN Technology Ltd Wolverhampton U.K.)
- 35 Developments of powders for the production of high speed steel bars and preformed components by a new process.
(P. Brewin Powdrex Ltd Tonbridge U.K.)
- 36 Production and assessment of forgings made from mechanically alloyed aluminium alloys.
(P. J. Bridges Inco Alloys Birmingham U.K)

- 1 Investigation of the influence of prealloyed silicon on the formation of nodular graphite.
(B. Lux Techn. Univ. Vienna A)
- 2 Application oriented mechanical properties of new types of spheroidal graphite cast irons.
(T. Varga Inst. for Testing and Research in Materials Vienna A)
- 3 Influence of impurities on castability and properties of aluminium die-casting alloys.
(E. Maier Vereinigte Metallwerke Braunau A)
- 4 Technological properties of Zn Al cast Alloys.
(B. Fink Karl Fink GmbH & Co Leibnitz A)
- 5 Development of low alloy acicular nodular cast iron.
(F. Hampaey CRIF Brussels B)
- 6 Assessment of flaws in cast aluminium components containing repair welds.
(J. Leupp Swiss Aluminium Ltd Neuhausen CH)
- 7 Improvement of weld-material for automatic or semi-automatic welding of creep resistant steel castings.
(E. Gerger George Fischer AG Schaffhausen CH)
- 8 Improvement of weld-material for automatic or semi-automatic welding of creep resistant steel castings.
(D. Christianus Thyssen Gieserei AG Muhlheim D)
- 9 Non-destructive testing of non-ferrous castings with ultrasonics, X-ra and Eddy currents.
(H. Crostack Univ. Dortmund D)
- 10 Production of improved spheroidal graphite cast iron qualities with high-strength and high ductility.
(K. Reiferscheid Chemetall Frankfurt D)
- 11 Application oriented mechanical properties of new type of spheroidal graphite cast irons.
(W. Schuetz Industrieanlagen Betriebsgesellschaft mbH Ottobrunn D)
- 12 Criteria for the formation of cracks during continuous casting of non-ferrous metals (especially with high melting point)
(W. Wunder Ver. Deutsch. Metall. AG Werdohl)
- 13 Technological properties of Zn Al cast alloys.
(K. Gruen Huttenwerke Tempelhof GmbH & Co Berlin D)
- 14 Influence of impurity enrichment, microstructural morphology and properties of sand cast recycled aluminium alloys.
(H. E. Exner Max Planck Inst. Stuttgart D)
- 15 Inoculation of spheroidal graphite cast irons: control of the inoculating products and study of their action mode.
(M. Hecht Cent. Techn. Ind. de la Fonderie Paris F)
- 16 Criteria for the formation of cracks during continuous casting of special steels.
(L. Holappa Helsinki Univ. of Techn. Espoo SF)
- 17 The use of squeeze cast aluminium alloy parts for applications.
(S. Hill GNK Technology Ltd. Wolverhampton U.K.)
- 18 The development of a consistent production route for the manufacture of high strength aluminium alloy castings.
(B. Rickinson HIP Ltd. Chesterfield U.K.)

- 19 The development of a consistent production route for the manufacture of high strength aluminium alloy castings.
(G. Richards Sterling Metals Ltd. Nuneaton U.K.)

PROJECT: COST 505

- 1 Advanced materials for the final stages of steam turbines.
(A. Kulmburg Vereinigten Edelstahlwerke AG Kapfenberg A)
- 2 Analysis of defect accumulations in forging by ultrasonic measurements.
(H. Doelle Brown Boveri & Cie Ltd. Baden CH)
- 3 Advanced materials for the final stages of steam turbines.
(E. Lachmann Industrieanlagen-Betriebsgesellschaft mbH Ottobrunn D)
- 4 Determination of true size of natural flaws in large forgings by means of ultrasonics.
(K. H. Mayer M.A.N. Nurnberg D)
- 5 Strength of weld metals.
(E. J. Magnusson ESAB AB Gotenborg S)
- 6 Strength of weld metals.
(P. Greenfield GEC Turbin Generators Whetstone U.K.)
- 7 Strength of weld metal.
(D. Widgery Murex Welding Prod. Ltd Herts U.K.)
- 8 Ultrasonic determination of defect size in large forgings.
(G. E. Goode NEI Parsons Ltd. Newcastle upon Tyne U.K.)

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