

PRACTICAL EXPERIENCE WITH MATERIALS TECHNOLOGY RESEARCH CENTRE IN OSTRAVA

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Abstract – Materials Technology Research Centre was established in Ostrava under Ministry of education, youth and physical training in the area of applied research. The main implementation centre is represented by Department of Metallurgy and Materials Engineering of Mining-Technical University and selected employees of some departments (even from other departments) and Vítkovice, Research and Development, s.r.o. This centre has also its internet page <http://mtvc.vsb.cz/> and an e-mail address mtvc@vsb.cz. Individual objectives for 2001 are based on general objectives which were specified during project design and they fully comply with developments needs of the material base in the Czech republic

Index Terms – Czech republic, research centre, university and enterprise cooperation

INTRODUCTION

By establishment of research centres the Czech state strives for deepening of quality of selected disciplines of scientific knowledge and will support development of those disciplines which exhibit domestic implementation background. This support of research in the Czech republic is in compliance with Principles of science policy in the Czech republic, as well as in compliance with National policy of research and development with the objectives to achieve comparable results with advanced countries in the area of research and development.

It is necessary to support collaboration at solution of more comprehensive issues of research and development, assistance at education of young experts and doctoral applicants and to establish conditions for elimination of remaining obstacles for merging of research capacities of universities, Academy of Science in the Czech republic and other institutionally supported research centres.

Moreover, the centres of basic research are required to interface with international research networks, to exhibit high level of references from abroad demonstrating, among others even in evident big interest in study or work stays in such centre. Regarding centres of oriented research, these are also required to show readiness of users for employing knowledge acquired at the centre.

The aim of „Research centre“ programme is following:

- Concentration of capacities and means to selected directions of research, increase of research quality focused on long-term requirements of application sphere, and as regards to aimed research, this should cover regional needs,
- Concentration of means to the limited number of centers of relevant size
- Increase of support of young research staff
- Support of collaboration of research teams of various institutions.

In the year 2000, under support of governmental programme of the Czech republic, Materials Technology Research Centre was established in Ostrava under Ministry of education, youth and physical training in the area of applied research. The main implementation centre is represented by Department of Metallurgy and Materials Engineering of Mining-Technical University and selected employees of some departments (even from other departments) and Vítkovice, Research and Development, s.r.o. This centre has also its internet page <http://mtvc.vsb.cz/> and an e-mail address mtvc@vsb.cz

MTVC LONG-TERM SCIENTIFIC OBJECTIVES

- Development of new unconventional types of construction materials including development of evaluation methods.
- Research and development of forming processes in relation to advanced design of bearing design elements. Material diagnostics, monitoring of manufacturing processes, evaluation of service life and reliability. Development of powder metallurgy and surface engineering.
- Development of waste-free technologies in metallurgy.

At the end of 2000 the Research Centre encountered in total 85 specialists, out of which 36 key ones and 49 skeleton ones.

Work team skills composition of the Centre is completely in accordance with demand level of the issue solution. Out of key specialists 13 are university teachers and 10 associate professors, 77 specialists have a university degree.

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The share of work capacity is in case of key specialists in overwhelming majority 30% and lower, in skeleton staff 70% to 100%. Average age of the Cetre staff is 38.8 years, out of which key ones 51.4 and skeleton ones 29.6 years.

ACTIVITY RESULTS IN 2000

Solution of individual objectives in each area can be summarised in following stages:

A. Evaluation of the structure stability of hardening and degradation processes in low-alloyed 9-12% Cr steels for conventional utilities. Evaluation of relations between microstructural and metallurgical parameters, brittle fracture and forming fracture characteristics in construction steel including resistance against hydrogen-induced cracking without applying external stress (NACE tests). Evaluation of mechanic properties of welded joints of 15 128 steel after long-term exposure in sub-creep area. Detailed evaluation of design ceramics of Si_3N_4 type as regards to its response on repeated load.

B. Development of experimental base in the area of simulation of hot and cold rolling of steel sheets and strips. Specification, verification and operation implementation of convenient physical, metallurgical and thermo-mechanical conditions of thick sheets of C-Mn-Nb-V steel rolling, of the yield point being 460, eventually 500 MPa for cold forming. Verification of thermo-mechanical rolling of sheets up to the thickness of 22, eventually of 25mm. Analysis of stability conditions of the forming process of 23MnB4 steel. Design of methodology of plastometric testing of strain characteristics. Cast of pilot melts for hydroprocess pressure vessels and their forming to sheets of final thickness of 100 mm.

C. Development of original methodologies of measurement and evaluation of mechanical and physical parameters of powder materials. Implementation of experiments of metal electroplating of new generation. Evaluation of brittle fracture properties of vitreous coats. Development of identification of the material model of Si dependency in pig iron and addition of steam in blast furnace wind.

D. Generation of studies entitled "Evaluation of metallurgical waste" and "Management of metallurgical technologies on the basis of gas analysis". Verification of control model of oxygen converters via method of neuron networks and determination of prospective of this method as regards to reduction material and utility level of demand. Performance of pilot melts with usage of the new plasma burner to achieve metallization of waste, including processing of engineering project of the specialised equipment for this process.

E. Research of new algorithms and methods of inspection of alternating control drives with asynchronous motors. Assessment of operation of microcomputer control system with DSPT MS 320 F 240. Simulation of active

performance filters on PC. Development of tensometric measurement. Collaboration at implementation of new technologies of magnet manufacturing. Issue of industrial networks and predictive management.

Usage of equipment

Existing equipment is being used both in VŠB-TU, and in Vítkovice and available capacities are used at maximum, as results from another 14 research projects. A lot of projects are also solved via sub-contracting and services of firms and schools in CR and abroad.

Draft project also considers supplies of more equipment in work areas in accordance with draft project investment plan.

Collaboration

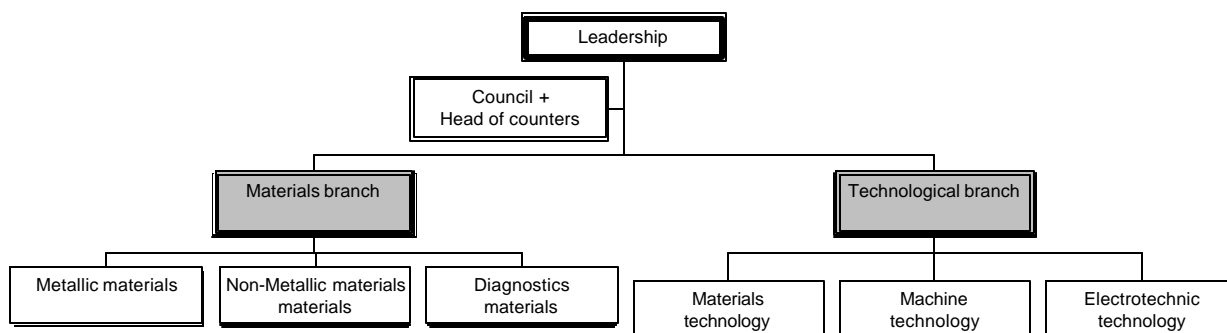
Many organisations in the Czech republic have shown their interest in professional collaboration. At the moment, 21 manufacturing organisations are overwhelming out of which 11 entities are from the regional application sphere. International activities encounter professional collaboration with 8 foreign institutes.

Doctoral programmes

Doctoral programmes implemented in the Centre are aimed at following areas:

- Evaluation of properties of construction metallic and ceramic materials as regards to brittle fracture parameters, resistance against hydrogen fragility and resistance against fatigue. Specification of changes of mechanical properties of weld joints of creep-resistance steels in sub-creep area.
- Application of organic polymeric material in the area of construction of transport and warehousing equipment of loose materials in connection with production in the food industry.
- Research of dynamic modelling of formability with process criteria functions and AC influence of electromagnetic field and phase transformations on strain behaviour of steels.
- Brittle fracture properties of vitreous enamel coating and properties and composite coats precipitating from electric coating.
- System of measurement of pollutants in connection with management of metallurgic technologies including use of chemical methods at waste processing and reduction of utility consumption at metallurgical processes.
- Electric machines, devices and drives, electronics and IT.
- Job of trainers of doctoral applicants is performed by 19 key specialists from the Centre with 8% capacity share. There are 43 doctoral applicants studying in the Centre.

STRUCTURE



OBJECTIVES

Individual objectives for 2001 are based on general objectives which were specified during project design and they fully comply with developments needs of the material base in the Czech republic.

Specified individual objectives are summarised as follows:

- I. Development of new types of micro alloyed and 9%-12% Cr steels for conventional utilities.
- II. Physical and metallurgical aspects of fraction processes including prediction of fractal parameters of fraction surfaces of construction steels.
- III. Evaluation of fatigue properties of construction oxide and nitride ceramics.
- IV. Experimental optimisation of progressive technologies of thermomechanic processing and ferrous rolling by control of thermal and strain parameters of the forming cycle.
- V. Evaluation of stress, plastic and stress-strain properties of materials on basis of iron, aluminium and copper.
- VI. Evaluation of hydrogen-induced cracking resistance in carbon steels used in industry of crude oil processing including evaluation of hydrogen fragility.
- VII. Research of micron and nanometric particles while focusing on powder metallurgy.
- VIII. Progressive procedures of production and out of furnace steel processing.
- IX. Usage of plasma and vacuum metallurgy for preparation and refining of non-ferrous metals.
- X. Issue of non-ferrous metals waste processing, assessment of recycling technologies.
- XI. Usage of artificial intelligence at managing of metallurgical processes.

CONCLUSION

General objectives of MTVC can be summarised in the following points:

- Concentration of capacities and means for selected directions of research
- Increased support of young scientists in solution of comprehensive research tasks
- Active share in education of doctoral applicants
- Support of collaboration of research teams of various institutions
- Implementation of results of research in the market

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