

Brochure „The New Neutron Source FRM II“

Preface

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The new research neutron source FRM-II is the biggest construction project in the 130-year-old history of the Technische Universität München. The scale of this measure corresponds to its significance for science and technology - in particular the degree of versatility with which we will in future be able to employ neutrons - the “better X-rays” - in basic research, applied research and technical applications. What X-rays do not “see”, neutron radiography does. The different complementary functions of these two forms of radiation are the preconditions for this.

Since most technical applications require a high neutron flux density and the opening up of new scientific areas is not possible using conventional neutron sources of an older construction type, the new research neutron source in Garching was so conceived to deliver as high a neutron flux density as possible at as low a thermal power rating as possible. The so-called compact core consists of a single fuel element - a cylinder measuring 24 x 70 cm. The fuel itself, high-density uranium silicide, is used in combination with highly-enriched uranium (HEU). This HEU compact core thus has the effect of improving the flux performance ratio by a factor of 2 in comparison with all other existing experimental research reactors. In addition, the safety features of the facility are greatly enhanced as a result of the employment of an “HEU core”.

The brochure at hand provides an insight into the manifold applications of neutrons and neutron research. Almost every field of science, technology and medicine is affected. Neutrons are not only needed for high-performance analysis (for example advanced environmental analysis), they are also required for material conversion processes, such as constitute the basis of the production of modern radiopharmaceuticals. This class of material has already today a world-wide turnover of approximately three thousand million marks, of which Germany has no share, owing to the lack of sufficiently powerful reactors. This is something which will change once the new source in Garching goes into operation.

The knowledge gained in basic research naturally has a high priority. Great attention is also paid to direct and indirect technical applications, for example

research into new materials or quality control of new materials. The investigation of biomolecular systems in particular is a domain of neutrons. Neutrons provide not only complementary but also fundamentally new information, as against experiments involving synchrotron radiation. For some time now it is common scientific knowledge that even slight alterations in the structure of biological building materials can lead to important changes in quality and behaviour. The structural alterations can be recognised especially well with the help of neutrons since neutrons can precisely register above all the lighter elementary building blocks (e.g. hydrogen atoms). By studying and understanding these structural and quality relations in the living organism with the help of such experiments, the secrets of life will not be unfolded but there can be no doubt that crucial insights will be gained which will prove advantageous for the advance of medicine.

This publication with its competent expert contributions shows how important the endeavours of the Technische Universität München on behalf of the new neutron source FRM-II were and just what priority this instrument is assuming at both national and international levels. Groups of research scientists - including many from other research facilities - are already busy constructing the new instruments which, immediately after routine operation commences, will be serviced by our high-performance source. The new generation of scientists are already in their starting blocks. The magnetic effect of FRM-II is beginning to exert its influence on a whole series of different scientific and technical disciplines.

In the name of all the future users from the fields of science, technology and medicine I would like to thank the Bavarian State government for its far-sighted initiative and its energetic support of this highly expensive facility and also the Bavarian Landtag for assuming the main funding. Our thanks too to the Federal Government for its participation in the costs of the installation and instrumentation. The trust placed in our scientific and technological know-how must stand as a high obligation for us all.