



# Lectio Materia

Newsletter of the

**ACADEMIA NDT INTERNATIONAL**

Science, Technology and Diagnostics in Non-Destructive Testing

## Dear Friends of the International NDT Community,

China organised this year's Olympic Games in a spectacular and splendid manner. The Games were a great success internationally, not only from a sporting perspective but also for their powerful message of peace, cooperation and friendship for all the world.

Now another important "Olympic Event" is taking place, the 17th World Conference on NDT.

A record number of participants is expected to attend the meeting. A high-technology exhibition will allow companies to display the very best in the latest NDT technologies.

Some 600 papers make up the technical programme.

A multitude of technical meetings are scheduled, dealing with many important topics.



**Professor Riccardo Giacconi, Nobel Prize winner**

And furthermore, for the first time in the history of the world conference, a Nobel Prize winner in the field of Physics, Prof RICCARDO GIACCONI of the Johns Hopkins University, will be present and shall deliver special lectures at the Opening Ceremony and during the first meeting of the ACADEMIA NDT International.

After more than 60 years of NDT, we have deepened our knowledge; we have made even more discoveries; we have built and refined equipment; we have pushed back the boundaries in the field of education; and we have raised the standards of the norms and guidelines for the qualification and the certification of NDT personnel.

All of these have served to improve the testing of materials and structures, which in turn has made a great and indispensable contribution to the safety and the wellbeing of people...

Thanks to all for your precious support in this new step in our profession; it is the greatest gift we can make to the new generation of NDT.



**Giuseppe Nardoni President, ACADEMIA NDT International**

## On the Importance of the ACADEMIA NDT International

'ACADEMIA' was the term which described the sacred place in ancient Greece where Plato is said to have had his Centre of Learning, an olive grove dedicated to the goddess of wisdom, Athena.

These days we understand an ACADEMIA to represent an accumulation of knowledge in a certain field of science. A Forum for the exchange of ideas, this brings together the most eminent scientists and experts to promote excellence in science and practice, facilitating solutions to the problems facing mankind. The idea of the ACADEMIA NDT International emerged a few years ago, reflecting a need in the NDT community to have a body that is evidence of the science present in the NDT field at the highest level and that was in a position to authoritatively speak about it.



**Members of the Council of the Academia NDT International at the meeting in Zagreb. L-R: Irena Pushkina, Vjera Krstelj, Vladimir Klyuev, Rainer Link, Giuseppe Nardoni**

ACADEMIA NDT International has been envisaged to foster Research, Development and Education in the NDT field by engaging NDT professionals in combined effort, thus attaining the goal of always seeking progress in the NDT field.

NDT people themselves need ACADEMIA NDT International as the everlasting spirit for persistency in their work, seeing it as a highly motivated association to assure them a better professional life.

For ACADEMIA NDT International to be established, a Steering Committee was formed whose 1st meeting was held on May 25th 2007 in Opatija, Croatia. This committee succeeded in establishing a strategic target.

ACADEMIA NDT International was founded in Moscow on March 10th 2008, declaring itself as:

- ◆ Non-governmental
- ◆ Non profit-making
- ◆ Impartial

A Council has been elected as the ACADEMIA's managing body, consisting of a President, two Vice Presidents, three Advisory members and an Executive secretary.

The President of the ACADEMIA NDT International, Dr Giuseppe Nardoni, is to be praised for his enthusiastic approach to every aspect. The Vice President, Dr Vladimir Klyuev is to be applauded for his support for the Academia's foundation activities in Moscow.

*Continued on page 2...*

## Science and Technology for Non-Destructive Testing and Diagnostics

### ACADEMIA Special Lecture Meeting

Shanghai, 26 October 2008

9:15 am – 13:00 pm, Room 5105, Hall East 2

Organised by the ACADEMIA NDT INTERNATIONAL

The scope of activities of the Academia shall embrace all means possible to prevent accidents and negative consequences caused by natural, technical or terrorist threats for the benefit of all mankind.

The condensed purposes and objectives of the ACADEMIA NDT activities are as follows:

- ◆ To promote science, research and development encouraging the application of the findings in the field of NDT at Universities, R&D centres and Institutions and other relevant bodies throughout the world.
- ◆ To establish and maintain a network among Scientists and Technologists involved in the basic sciences, research and development for NDT methods, techniques, equipment and implementation advancement.
- ◆ To highlight the work of the research and development in NDT.
- ◆ To be mindful of the contributions from scientists and distinguished professionals in NDT field, inviting them to ACADEMIA NDT
- ◆ To attract attention of international authorities, government and public organizations to the importance of the benefits that NDT provides.

Activities of the ACADEMIA shall be pursued by various means, in particular: organizing committees, commissions, working groups, participating in NDT congresses, conferences and publishing material.

ACADEMIA NDT is not in competition with NDT associations and institutions such as ICNDT (International Committee for NDT) or other regional NDT groups, nor with the National societies, but sees itself as an association complementary to all these.

The membership of the ACADEMIA NDT comprises Full and Honorary members. At least once a year the members of ACADEMIA will assemble for discussion of the latest developments. In case-by-case meetings, actual problems or events may be analyzed.

These meetings will be held with open doors, since the decision-taking procedure has to be transparent. If there are different opinions, they have to be visible and the opinion of minorities must be declared.

ACADEMIA NDT will rely on successful work of its members and appreciated contributions by sponsors and donors.

Three ACADEMIA NDT Council meetings have already been held.

ACADEMIA NDT activities of prime importance for Non-Destructive Testing and Diagnostic Technologies were presented at some NDT meetings (Moscow and Los Angeles). However, such an important event as the foundation of the ACADEMIA NDT requires wider presentation and the forthcoming 17th World Conference on NDT in Shanghai presents such an opportunity.

To this end, the ACADEMIA Council is organizing its 1st Special Lecture Meeting to be held during the 17th WCNDT in Shanghai.

The ACADEMIA NDT extends its deep gratitude to the Chinese NDT Society for this opportunity.

ACADEMIA NDT has to date no less than thirty Full members, all very well known and outstanding scientists and technologists.

Two of ACADEMIA NDT members, Dr Gerd Dobmann from the Fraunhofer Institute in Germany, and Dr Baldev Raj from the Indira Gandhi Center for Atomic Research in India will present papers on their valuable achievements in the NDT field. ACADEMIA NDT is grateful for the efforts of speakers in the Programme and to the Institutions supporting them for this event.

And we are proud to announce that Professor Riccardo Giacconi, Nobel Prize Winner for Physics in 2002, has willingly accepted our invitation to present a 'Lectio Magistralis' at this 1st Special Lecture Meeting. We are very honoured and grateful to Professor Giacconi.

#### Honorary members of the ACADEMIA NDT International:

- ◆ Professor JEROME KARLE, US Naval Research Laboratory Nobel Prize 1985
- ◆ Professor RICCARDO GIACCONI, Johns Hopkins University Nobel Prize 2002
- ◆ Dr ISABELLA KARLE, US Naval Research Laboratory
- ◆ Professor ANATOLY K GURVICH, Russian Academy of Transport
- ◆ YULIJ VIKTOROVICH LANGE, SPECTRUM, Moscow, Russia
- ◆ Professor MORIO ONOE, University of Tokyo

*On behalf of ACADEMIA Council  
Professor Vjera Krstelj, Dr Rainer Link  
Zagreb, October 2008*

## Professor Riccardo Giacconi, Nobel Prize winner

## Biography



Riccardo Giacconi is a professor in the Department of Physics and Astronomy of the Johns Hopkins University. His research is in experimental astrophysics. In 2002, he was awarded the Nobel Prize for Physics for his seminal discoveries of cosmic sources of X-rays, which helped lay the foundations for the field of X-ray astronomy.

Giacconi received a PhD from the University of Milan in 1954. In 1959 he joined the research firm American Science and Engineering, and in 1973 he moved to the Harvard-Smithsonian Center for Astrophysics. He later directed the Space Telescope Science Institute (1981-93) and the European Southern Observatory (1993-99). In 1999 Giacconi became president of Associated Universities, Incorporated, which operates the National Radio Astronomy Observatory.

Giacconi began his award-winning work in X-ray astronomy in 1959, about a decade after astronomers had first detected X-rays from the Sun. Because X-rays emitted by cosmic objects are absorbed by the Earth's atmosphere, this radiation could be studied only after the development of sounding rockets that could carry X-ray detectors above most of the atmosphere for brief flights.

Giacconi conducted a number of these rocket observations; the

data led to the detection of intense X-rays from sources outside the solar system, including the star Scorpius X-1 and the Crab Nebula supernova remnant.

Giacconi's achievements piqued the interest of other scientists in the nascent field of X-ray astronomy, but their research was hampered by the short observation time afforded by rockets. For long-term studies Giacconi encouraged construction of an Earth-orbiting X-ray satellite to survey the sky.

Named Uhuru (launched 1970), it raised the number of known X-ray sources into the hundreds. Earlier, Giacconi had worked out the operating principles for a telescope that could focus X-rays into images, and in the 1970s he built the first high-definition X-ray telescope. Called the Einstein Observatory (launched 1978), it examined stellar atmospheres and supernova remnants, identified many X-ray double stars (some containing suspected black holes), and detected X-ray sources in other galaxies. In 1976 Giacconi proposed a still more powerful instrument, which was finally launched in 1999 as the Chandra X-Ray Observatory.





Dr Gerd Dobmann was born in Saarbrücken, home of the Fraunhofer Institute for Non-Destructive Testing (IZFP), one of the world's leading Institutes engaged in research and development concerning the physical principles of NDT, materials characterisation and control and monitoring of production processes and industrial plants and components. Dr Dobmann is currently an Advisory Director of the Fraunhofer IZFP responsible specifically for process monitoring and control and basic research.

Dr Dobmann studied at the University of the Saar Region and conducted his thesis in applied physics and electrical engineering,

theoretical electrodynamics, on the subject of 'The calculation of the electromagnetic field of a vertical electric dipole on a periodic rough earth surface', with Dr K-D Becker. At this stage he began his research activities with the Fraunhofer IZFP in 1974. In 1975 he commenced his doctorate thesis on 'Theoretical, numerical and experimental investigations into the application of the electrical direct current potential drop techniques in NDT'.

In 1976 Dr Dobmann was appointed head of a scientific working group: 'Electrical, magnetic and thermal techniques in NDT' at Fraunhofer and in 1978 he became head of the Electromagnetic Techniques department, a group of three scientific working groups, eight scientists, four engineers, three technicians and four PhD students. In 1979 he was awarded his PhD in Applied Physics 'magna

cum laude'.

Gerd Dobmann was organiser of the 3rd International Symposium 'Materials Characterization' in 1988 and editor of the conference proceedings. As deputy to the Institute Director at Fraunhofer, he is responsible for the research plan of the IZFP and is director of the 'scientific projects' division.

Dr Dobmann has published numerous technical papers and three texts in the field of theoretical electrodynamics in co-operation with Prof K-D Becker and Dr K-J Langenberg.

He is author of 4 chapters in specific monographs to NDT, Editor of the 'Handbook on the Magnetic Examination of Welds' (published in 1988 by the British Welding Institute) and author of the 'IIW Handbook on the Non-Destructive Measurement and Analysis of Residual Stress in and around Welds' (published in 1993 by the US American Welding Council).

He is a member of the German Society for Non-Destructive Testing (DGZFP), chairman of the Saarbrücken Working Group, and deputy chairman of the NDT in Civil Engineering Committee and deputy chairman of the Ultrasonics Committee. He is a Fellow of the Institution of Electrical Engineers (now IET) and a Chartered Engineer registered by the UK Engineering Council.

Gerd Dobmann is Chairman of Commission V of the IIW, 'NDT and Quality Assurance', Member of the American Society for Materials, ADMS, European Chapter, Honorary Member of the Indian Society for NDT and was Chairman of the Programme Committee of the European Conference in EC NDT 2006 in Berlin.

## **Physical Basics and Industrial Applications of 3MA – Micromagnetic Multiparameter Microstructure and Stress Analysis**

Gerd Dobmann

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Micromagnetic NDT techniques<sup>[1]</sup> like the measurement of the magnetic Barkhausen noise, the incremental permeability and the harmonic analysis of the tangential magnetic field allow the definition of inspection procedures to online monitoring and control machinery parts and components in production processes in order to characterize mechanical properties such as hardness, hardening depth, yield and tensile strength.

These types of inspection procedures continuously were further developed in the last two decades so that today the second generation of system hard and software is in industrial use. The application is in steel industry where steel sheets in hot-dip-galvanizing lines were annealed after cold rolling but also in heavy plate rolling mills where after thermo-mechanical rolling special textures and texture gradients can occur. The figure below the text documents the last mentioned application where the inspection system is integrated in a trolley which remotely controlled can operate on the heavy plate.

An increasing number of applications are also to find in the machinery building industry and here especially in case of machinery parts of the car supplying industry. Besides mechanical hardness and hardening depth determination the measurement of residual stresses and the detection of in-homogeneities in the surface of machined parts is an inspection task, i.e. after grinding. Structural gradients, in terms of strength and/or hardness into wall thickness direction are to characterize in car engines made by steel casting.

The contribution introduces in the methodology of the micromagnetic, multiparameter, microstructure and stress analysis (3MA), which, however, only can be applied at ferromagnetic materials and describes the physical basics of the techniques. The applied

technology is especially sensitive for mechanical property determination as the relevant microstructure is governing the material behavior under mechanical loads (strength and toughness) in a similar way as the magnetic behavior under magnetic loads, i.e. during the magnetization in a hysteresis loop. In different case studies the advantage to implement 3MA into the industrial processes is discussed. Special emphasis of the lecture is also to discuss future potential applications for characterizing ageing phenomena.



**Heavy steel plate inspection (hardness, mechanical strength) by means of an inspection trolley on the roller table position**

### References

[1] I Altpeter, R Becker, G Dobmann, R Kern, W Theiner and A Yashan, *Inverse Problems* 18 (2002), S. 1907-1921

### ACADEMIA NDT INTERNATIONAL

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Dr Baldev Raj, BE, PhD, Member, German National Academy of Sciences, Fellow, Third World Academy of Sciences and Fellow of all Engineering and Science Academies in India is a Distinguished Scientist & Director at the Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu, India. His specializations include materials characterization, testing and evaluation using non-destructive evaluation methodologies, materials development and performance assessment and technology

management. He steers science and technology programmes at IGCAR with a mission to develop world-class technology in fast breeder reactors and fuel cycle technology through the mechanism of scientific breakthroughs and transferring science to robust technology. He is currently engaged in technology management of fast breeder reactors and fuel cycle technology.

Baldev Raj has more than 600 publications in leading refereed journals and books. He has co-authored 12 books and co-edited 30 books and special journal volumes. He has 5 Indian Standards and 16 patents to his credit. He is Editor-in-Chief of two series of books: one related to NDE Science & Technology and another related to Metallurgy & Material Science. He has contributed 9 articles

in Encyclopaedia. He is on the editorial boards of national and international journals. He has won many awards and honours, notable among them being the National Metallurgist Award (2007), G.D. Birla Gold Medal (1996), MRSI-ICSC Superconductivity & Materials Science Annual Prize (2004), Life Time Achievement Award of Indian Society for Nondestructive Testing (2004), Indian Welding Society (2004), Jaeger Lecture Award of International Institute of Welding (2004), International Researcher Award of International Committee on NDT (2000-2004), Indian Nuclear Society Award (2004). He is recipient of Padma Shri from Govt. of India, Distinguished Alumni Award (2007) of Indian Institute of Science (one of the premier research institutes in India) for sustained excellence in Science and Technology, Prof Jai Krishna Memorial Award-2008 (awarded to one eminent engineer every year for outstanding contributions in engineering, technology and application by Indian National Academy of Engineering).

He is member, Global Energy International Prize Committee, National Nanotechnology Advisory Board of South Africa; Chairman of India-Brazil-South Africa Initiative on Nano Science & Technology; Founder Member, Council of Academia NDT International; Member, Scientific Advisory Committee to Prime Minister of India, Scientific Advisory Committee to Cabinet, Govt. of India and Nano Mission Council, of the Department of Science & Technology.

His interests include technology management, heritage, philosophy, religion and education.

## Science and Technology for Non-Destructive Testing and Diagnostics

### ACADEMIA Special Lecture Meeting

Shanghai, 26 October 2008

9:15 am – 13:00 pm, Room 5105, Hall East 2

Organised by the ACADEMIA NDT INTERNATIONAL

### PROGRAMME

#### 09:15 **Welcome Greetings**

*President:* Giuseppe Nardoni

*Vice-President:* Professor Vladimir V Klyuev

#### **Presentation of the Academia NDT International**

Professor Vjera Krstelj

#### **Lectio Magistralis**

10:00 Special Lecture by Nobel Prize Winner for Physics 2002, Prof RICCARDO GIACCONI, Johns Hopkins University, USA

#### **X-Ray, Gamma Ray, the language of the Stars: achievements in the knowledge of the Universe – 50 years of Research**

11:00 *Coffee Break*

*Chairmen:* Drs R Link and S Vahaviolos

11:15 Lecture by Dr GERD DOBMANN,

Fraunhofer Institute for Non-Destructive Testing, Saarbrücken, Germany

#### **Physical Basics and Industrial Applications of 3MA – Micromagnetic Multiparameter Microstructure and Stress Analysis**

12:00 Lecture by Dr BALDEV RAJ,

Indira Gandhi Center for Atomic Research, Kalpakkam, Tamil Nadu, India

#### **Ethics, Equity and Energy**

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