Laudatio for Prof. Božidar Liščić on the Occasion of his 80th Anniversary*

Dear Prof. Liščić,

Ladies and gentlemen,

Being one of Prof. Liščić's long-standing collaborators, it is my privilege to shortly describe his professional career, his activities and achievements.

After his graduation 1954 from Technical Faculty of the University in Zagreb, Prof. Liščić has worked for 10 years in the then biggest Machine-Tools factory "Prvomajska", starting as head of Heat Treatment Department.

His first specialization 1956 was the course on salt-bath heat treatment at the company Degussa-Durferrit in Frankfurt, Germany.

Later other specializations followed: 1959 on machine tools production at "Progress Industriell", Bruxelles, and tools production at ACEC, Charleroi, Belgium, 1964 on production organization at the Machine-Tools factory "Pittler", Langen, Germany, and 1967 in the research center of the metallurgical company "HOESCH", Walzwerke Hohenlimburg, Germany.

On the end of his employment in industry, being only 32 years of age, he was technical manager of the mentioned Machine Tools Factory having about 3000 employees. Based on his industrial experience he served four years as advisor for the metalworking industry in the Chamber of Commerce in Zagreb.

In February 1968 he came to the Faculty for Mech. Engineering in Zagreb, as lecturer in heat treatment. There he established a well equipped Heat Treatment Laboratory which soon became the best heat treatment education and research facility in Croatia. New heat treatment technologies had been transferred for the first time into Croatia (TENIFER-Nitriding process, Vacuum furnace technology, CARBO-MAAG gas carburizing, Boronizing). As head of this laboratory for many years, he established broad and fruitful cooperation with industry.

In 1975 he defended his doctoral thesis: "Depth of Hardening as Function of Steel Hardenability and of Quenching Parameters", and received his PhD on material science from the University of Zagreb. Part of experiments for this disertation Prof. Liščić has performed at the Max-Planck Institut für Eisenforschung in Düsseldorf, Germany, and the other part in the laboratory in Zagreb, using an experimental quenching tank built for these experiments by the Swiss company BOREL. Later a unique salt bath furnace for Martempering and Austempering was built for the laboratory in Zagreb, according to American design (AJAX-Cataract Quench Furnace). All these developments directed his research attention to **quenching** which became the main field of his interest. To this time the focus of his research work was devoted to the methods of quenching intensity measurement. In cooperation with the American company NANMAC a special quench probe known as *Liscic/Nanmac* probe was developed for measuring and recording the quenching intensity in workshop conditions. His main scientific achievement is doubtlessly the invention of the *Temperature Gradient Method* for quenching intensity measurement, recording and evaluation.

Continues on the page 28

*This issue of the *Journal Strojarstvo* is dedicated to Božidar Liščić, fellow of the Croatian Academy of Sciences and Arts, while Prof. D. Sc. Božo Smoljan selected the papers from the *International Conference New Challenges in Heat Treatment and Surface Engineering*, Dubrovnik 2009.

Continued from the page 3

This method has been referred to in professional journals in: Germany, USA, England and Ukraine. Its partial or full description is given in several books. Already 1978 Prof. Liščić has published the article: "Der Temperaturgradient auf der Oberfläche als Kenngrösse für realle Abschreckintensität beim Härten", Härterei-Technische Mitteilungen, Band 33, Heft 4, s.179-191.

Soon after that, based on the first results with the *Liscic/Nanmac* probe, using the aforementioned experimental quenching tank, the laboratory in Zagreb received orders to examine the quenching intensity of their polymer solutions from world leading producers: UNION CARBIDE Chemicals & Plastics, USA; BRITISH PETROLEUM, Hyat Chemicals, UK; HOUGHTON-Hildesheim, Germany.

Based on the use of the *Liscic/Nanmac* probe a unique *Temperature Gradient Quenching Analysis System* software package has been developed at the Faculty for Mechanical Engineering University of Zagreb. Some years later, based on the same method the company IPSEN INTERNATIONAL GmbH, Kleve, Germany has 1995, as the first in the world brought to the market the „*Flux Control*", a computer aided system for measuring the quenching intensity and calculation of the heat transfer coefficient at High Pressure Gas Quenching in vacuum furnaces. The main feature of the system is the *IPSEN-Liscic sensor*.

Another important scientific achievement of Prof. Liščić is the cognition that PAG polymer-solutions of high concentration may be used for *Controllable Delayed Quenching*, provided adequate steel hardenability and cross-section size of the work-piece are involved. This technology can substantially enhance the depth of hardening.

In the field of High Pressure Gas Quenching in vacuum furnaces, based on already performed experiments, he has proposed an algorithm for automatic control of the cooling intensity by simultaneous use of the volume gas flow and transient spraying of liquid nitrogen, which would lead to *Controllable Heat Extraction Technology.*

His activity in the field of quenching has been observed by then leading persons of the International Federation for Heat Treatment (IFHT). In 1977 he was invited by Mr. Urs Wyss, the first General Secretary of IFHT, to establish an international committee on quenching. During the international congress TRATERMAT, 9-12 May 1978 in Barcelona, Spain the Technical committee „Scientific and Technological Aspects of Quenching" of the IFHT was established, and Prof. Liščić became his Chairman for the 23 following years. During his Chairmanship, among other activities, the International Standard for laboratory testing of quenching oils ISO-9950 was introduced, based on which later a similar standard the ASTM D-6200-97 has been elaborated in USA. A good cooperation between the IFHT Technical committee and the ASM Committee on Quenching and Cooling in USA was established.

Prof. Liščić became Full Professor at the Faculty for Mech. Engineering in Zagreb in 1982, and occupied this position until his retirement in 1999.

During the period 1971-1990 he has served as UNDP expert for heat treatment in the following countries:

- 1971, ISRAEL, Small Industry Advisory Centre, Tel-Aviv (5 months),
- 1972/73, INDIA, Advanced Training Institute Guindy, Madras (one year),
- 1978, EGYPT, Engineering and Industrial Development Centre, Cairo (6 months),
- 1980, TURKEY, Industrial Training and Development Centre, Ankara (2 months),
- 1983/84, BANGLADESH, Bangladesh Machine Tools Factory, Dhaka (1.5 years),
- 1986/87, INDIA, Central Institute of Agricultural Engineering, Bhopal (2 months),
- 1986/87, PAKISTAN, Farm Machinery Institute, Islamabad (2 months) and
- 1989/90, PAKISTAN, Pakistan Machine Tools Factory, Karachi (3 months).

In 1992 he spent two months as visiting professor at the Department of Mechanical Engineering , the University of Cincinnati, Ohio, USA.

Prof. Liščić has published about 100 scientific papers and contributed to 4 professional books. He was the first editor of the book: B. Liščić, H.M. Tensi, W. Luty" Theory and Technology of Quenching", Springer-Verlag, 1992, the Second Edition of which is to be published this autumn.

He has delivered more than 60 public lectures in 13 different countries, among them the following invited lectures:

- 1988 At the Seminar on Quenching, Ukrainian SSR Academy of Sciences, Kiev, Ukraine,
- 1991 At the IPSEN-Tagung, Düsseldorf, Germany,

- 1991 At the 3rd International Seminar IFHT„Quenching and Carburizing“, Melbourne, Australia,
- 1992 At The 8th International Congress on Heat Treatment of Materials, Kyoto, Japan,
- 1992 At the Workshop on Quenching, Detroit, Michigan, USA,
- 1997 At the Workshop: Development, Testing and Processing of Contemporary Functional Construction and Tool Materials, Ljubljana, Slovenia,
- 1997 At the 5th Conference on Materials and Technologies, Portorož, Slovenia,
- 1999 At the Technische Universität, Graz, Austria,
- 1999 At the 7th International Seminar of IFHTSE, Budapest, Hungary,
- 2000 At the 20th ASM Heat Treating Society Conference, St. Louis, Mo, USA,
- 2001 At the 21th ASM Heat Treating Society Conference, Indianapolis, IN, USA,
- 2006 At the Härterei- Kolloquium HK 2006, Wiesbaden, Germany and
- 2008 At the Workshop on Quenching, National Institute of Technology Karnataka, Mangalore, India.

Prof. Liščić is member of:

- ASM International, USA,
- Arbeitsgemeinschaft Wärmebehandlung und Werkstofftechnik e.V. (AWT) Germany,
- Board of Editors of the journal JINSHU RECHULI (Heat Treatment of Metals), Beijing, China,
- Founding member of the ASM- Heat Treatment Society,
- 1988 Elected ASM Fellow,
- 2001-2003 Elected Vice President of the International Federation for Heat Treatment and Surface Engineering (IFHTSE) and
- 2004-2005 President of IFHTSE.

He has received the following awards:

- 1976 Grand Medal of the Faculty for Mech. Engineering, Zagreb, for establishing the Heat Treatment Laboratory,
- 1989 The award „Nikola Tesla“ for scientific achievements from the Republic of Croatia and
- 2006 The Adolf Martens Medal, the highest award of the AWT, Germany.

From 1997 Prof. Liščić is Full member of the Croatian Academy of Sciences and Arts (HAZU).

As official representative of HAZU in the period 2003-2008 he was member of the Standing Committee for Physical and Engineering Sciences (PESC) of the European Science Foundation (ESF).

In the name of all his colleagues and collaborators, I wish him further all the best.

Prof. D. Sc. Božo SMOLJAN