Editorial

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Biographical notes: Mario Rosso is a full Professor in Metallurgy at the 1st Engineering Faculty of the Politecnico di Torino. He is the author of more than 250 papers published in scientific reviews or in conference proceedings. They concern different aspects related to metals and alloys, particularly, surface engineering of steels and of sintered alloys, heat treatments, application of thermal spray and PVD processes to obtain high-performance coatings, surface-layer properties, corrosion and wear resistance, hard metals, powder metallugy and MIM, formability of alloys and steels, innovative casting technologies, performances of dies for diecasting, hot and cold working tools, heat checking and thermal fatigue resistance. Rosso is a member of the World Academy of Materials and Manufacturing Engineering, the European Powder Metallurgy Association, the APMI International and the Italian Association of Metallurgy. Moreover, he is a member of many scientific review committees, as well as for international conferences.

Janez Grum is a Professor of Materials Science at the University of Ljubljana, Faculty of Mechanical Engineering. He is also the founder and Editor-in-Chief of the *International Journal of Microstructure and Materials Properties* (*IJMMP*) and has been Editor of the *Journal News of Society for Nondestructive Testing*, by the Slovenian Society for Non-Destructive Testing, Ljubljana, Slovenia since 1994. He is also a member of several international journal editorial boards. He is the editor of six NDT Conference Proceedings, two ASM and Marcel Dekker book chapters, and five books with several reprints. He has also published more than 200 refereed journal papers and more than 400 conference papers on heat treatment and surface engineering, laser materials processing and materials testing, including non-destructive testing.

The papers collected in the present issue of the IJMMP were presented at the *7th International Tooling Conference* on 'Tooling materials and their applications from research to market'. The conference was held at the Polytechnic of Torino, which is located close to the city centre. The Polytechnic of Torino is the oldest technical university in Italy. Torino itself is a city where different cultures meet. It is a university and industrial town, as well as a commercial and financial centre. Owing to its geographical position, it is also known as the Capital of the Alps. It was the venue of the Winter Olympic Games in 2006. On the occasion of the conference, Torino was still giving the impression of being an Olympic city.

During the four-day conference, that took place from 2 to 5 May, 163 papers, *i.e.*, 126 oral lectures and 37 posters were presented. The Select Scientific Board of the Conference selected 36 papers and invited their authors to contribute to the present special edition. All the selected and received papers were reviewed as required by the journal's publisher. Finally, 23 papers were selected, after having been corrected as required by their reviewers, for the publication in the present issue of the *International Journal of Microstructure and Materials Properties* (IJMMP).

As the conference title indicates, this conference was only one in a series of the so-called International Tooling Conferences, which had been started in Chicago (USA). Later the conference moved to Europe so that further conferences were held in Switzerland, Germany, Austria, Sweden, and finally in Italy. Steel manufacturers and conference sponsors such as Böhler, Uddeholm, Edelstahl Witten-Krefeld, and others have done their best to promote the periodic recurrence of the conference.

Böhler Edelstahl is one of the leading manufacturers of tool steels, high-speed steels, and special steels. Edelstahl Witten-Krefeld is a group consisting of several manufacturers. They are the largest manufacturers of tool steels, high-strength steels, and stainless steels. Uddeholm Tooling from Sweden is the largest manufacturer in the Uddeholm Group of steel manufacturers. It is a well-known tool steel manufacturer. Developers and manufacturers of tool steels endeavour to satisfy the increasingly demanding users of tool steels, high-speed steels, and special steels, which are used for manufacturing tools or exacting structural components. The quality of individual types of tools shows in their long life. The life of a tool involves tool treatment in terms of wear and other changes occurring in tools during operation, which, however, exert no influence on the product quality. It is also closely related to tool manufacturing procedures and the type of tool with complementary operating conditions, which determine the tool behaviour in operation. If a tool is to be a success, all individual actions such as the choice of adequate steel and of excellent design and high-quality manufacture of vital tool components should be carried out efficiently.

Poor choice of steel, inadequate design solutions and poor manufacture can reduce the tool life to only 20% of the anticipated life of an excellent tool. Consequently, industrial users of steel in the metalworking industry shall have at their disposal highly qualified experts with adequate knowledge of tool design so that high-quality tools with the longest possible life can be manufactured. Tools being usually very exacting and expensive, tool costs per unit of product may represent an important fraction in the tool price. Increased tool endurance will result in increased tool life and more favourable economic results, which will show in the price of the product made using this tool.

The contributions published mainly treat hot-working steels (15 papers), cold-working steels (four papers), high-speed steels (two papers), and tool steels for working polymeric materials (two papers).

A survey of the papers shows that the hot-working steels are predominating. The hot-working steels treated are intended mainly for the production of tools for die casting of various non-ferrous alloys. Such tools shall withstand high thermo-mechanical cyclic stresses and are susceptible to surface wear and material fatigue. Tool wear is accompanied also by the initiation and propagation of cracks, which may result in catastrophic tool failure. To ensure the long life of tools used for high-quality products and castings, the choice of adequate steel, good tool design, and quality manufacture of tools are highly important. This can be accomplished if the right information, experts knowing how to use the information, suitable machines and devices for tool manufacture are available. The papers in this special issue are focused on the choice of steels, their properties and behaviour under dynamic loading, taking into account different heat-treatment conditions and surface engineering. Some papers treat, however, investigations to describe tool conditions from the viewpoint of tribology, where a relation between surface integrity after machining and heat treatment and surface treatment, and influences of different machining processes, from a blank to a finished vital component of a tool, on surface and surface-layer quality shall be considered. Surface integrity defines the variations of hardness and residual stresses in the thin surface layer. The knowledge of the surface microstructure makes it possible to predict tool behaviour in operation and determines the tool life. Tool quality can thus be provided by means of constant monitoring of the tool condition and/or constant product control.

Any deviation in product quality can thus be noticed by means of constant monitoring of tool condition and/or constant control of product quality, *i.e*., casting quality. In order to improve surface integrity the authors studied, in addition to heat treatment, various surface heat-treatment processes, mechanical or thermo-mechanical and thermo-chemical processes of hardening. The aim of additional tool-surface treatments was to lower the coefficient of friction between the tool surface and a product, *i.e*., to reduce tool wear with surface refining. The investigations dealt mainly with the influences on material fatigue under thermo-mechanical loading and only to a lesser extent with tool wear and damage.

The present overview offers the reader numerous scientific results obtained in the field of non-destructive testing and evaluation, and provides him with numerous references of the researchers treating the problems concerned in a comprehensive way. It also gives him a good insight into the present state of research in the field, widens his knowledge of the issues and is, as such, very suitable as a study aid to undergraduate students and even more so to postgraduate students.

Special thanks are due to the authors who have contributed their papers to this special issue of the IJMMP. They are a result of very critical work of reviewers and the authors. It can be said that the papers satisfy high standards of quality.

Our great thanks are due also to our co-workers, Mr. Franc Ravnik (BSc), and Ms. Nevenka Majerle, who took care of the coordination among the reviewers and the authors, and prepared the papers for the publication.

We sincerely hope that the papers presented on non-destructive testing and evaluation will be a valuable source of information to researchers in various scientific fields, and users in the field of materials and production.