Editorial

Janez Grum

Faculty of Mechanical Engineering
Aškerčeva 6, 1000 Ljubljana, Slovenia
E-mail: janez.grum@fs.uni-lj.si

Biographical notes: 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 a new journal *International Journal of Microstructure and Materials Properties (IJMMP)* and has been Editor of the *Journal News of Society for Non-destructive Testing*, Slovenian Society for Non-destructive Testing, Ljubljana, Slovenia since 1994. He is Editor of the six NDT Conference Proceedings, two ASM and Marcel Dekker book chapters and five books with several reprints. He has also published more than 100 refereed journals and more than 300 conference papers on heat treatment, laser materials processing and materials testing including non-destructive testing.

Papers presented in this issue are selected from the *11th International Scientific Conference on Contemporary Achievements in Mechanics, Manufacturing and Materials Science – CAM^{3}S '2005*, which was held in Gliwice – Zakopane, Poland on 6–9 December 2005. The main aim of the conference was to present and discuss new trends in the development of materials, manufacturing engineering and technologies.

The CAM^{3}S '2005 Conference was a special one because the scientific staff of the Institute of Engineering Materials and Biomaterials of the Silesian University of Technology in Gliwice organised it, and dedicated their organisational efforts and preparatory works to be presented at the conference to an eminent scientist, a continuator of the Silesian School of Physical Metallurgy, Professor Adamczyk on the occasion of his 70th birthday.

The authors dedicate their papers included in this volume to the memory of Professor Jan Adamczyk who died unexpectedly during the work on this volume and will be sadly missed. He was an outstanding physical metallurgist who became an unequalled paragon for many who had the opportunity to know him personally or his works during his almost 50-year scientific career in the Silesian University of Technology in Gliwice. His commemoration paper worked out over one year ago together with one of his youngest doctors will never be read by him and would be one of his last published works.

Twelve papers were selected for publication in a special issue titled 'Materials Science and Technology'.

Adamczyk *et al.* discuss about optimal heat treatment conditions and microstructure of the medium-carbon steel strengthened by plastic deformation. They found out that ferritic bainite contains a very small fraction of carbides with a 23% fraction of retained

austenite, showing thermal stability. It was found that the retained austenite occurs as regular grains of 3 μm in diameter between bainite laths. The tensile test shows that the steel is characterised by high-strength properties and excellent ductile properties.

Derez *et al.* studied a composite powder of high corrosion resistance prepared by self-propagating high-temperature synthesis material, which was crushed, and of powdered grain size material after crushing in the range of 20–45 μm followed by milling for two and ten hours. The powder morphology was analysed by scanning electron microscopy and X-ray diffraction methods were applied for the structure analysis. The Rietveld method appeared to be very useful in the verification of the qualitative phase composition and in the determination of phase abundance. The parameters of diffraction line profiles were determined by the PRO-FIT Toraya procedure. The crystallite sizes and lattice distortions were analysed using the Williamson-Hall method. They stated the presence of Cr_7C_3, FeCr and FeO and most importantly, FeAl (Cr), Cr_3C_2 and TiC. They found that the FeAl (Cr) phase is of the ordered B2-type structure and the ordering degree diminishes with the increase of milling time.

In the first paper, Dobrzanski *et al*. presented a material and technological solution that makes it possible to obtain hard magnetic composite materials from powdered rapid quenched Nd-Fe-B strip bonded by polymer matrix. The complex relationship among the manufacturing technology of these materials, their microstructure, as well as mechanical, magnetic properties and corrosion resistance were evaluated.

In the second paper, Dobrzanski *et al.* presented the results of the heat treatment effect on the properties and corrosion resistance of the sintered composite materials with the EN AW-AlCu4Mg1 (A) alloy matrix reinforced with Ti (C, N) particles with various volume fractions. They found out that portions of reinforced particles had an effect on the increase of hardness and decrease of compression strength, tensile strength and abrasive wear.

Farrahi *et al.* studied fatigue damage caused by actual roads and manoeuvres on proving ground using the ADAMS and MSC/NASTRAN packages. The fatigue damage caused by straight driving on the roads with different qualities and driving in cornering and braking states was estimated at rear spindle. The number of cycles that should be driven on the proving ground to reach the equivalent accumulated fatigue damage in design life was calculated.

Greger *et al.* studied Equal Channel Angular Pressing (ECAP) as an effective tool for attaining ultrafine grain sizes. They provided a basic analysis of grain size influence on mechanical properties and experimentally determined the development of copper structure and equal channel angular pressing properties.

Haga *et al.* designed a high-speed twin-roll caster and used it in order to increase casting speeds. Several Al-Mg-Si alloys were cast at a speed of 60 m/min. Strips thinner than 4 mm can be cast continuously from the Al-Mg-Si alloys. The strips have an equated, rather than columnar grain microstructure. Rolled strips of 0.5 mm thickness with T4 heat treatments are not broken after 180-degree bending. The retained eutectic Si particles after T6 heat treatment are spherical and smaller than 5 μm.

Kajzer *et al.* presented the influence of the surface treatment and plastic strain of Cr-Ni-Mo stainless steel on their corrosion resistance. The deformability tests of the passive layer were carried out with the use of a bend test and a subsequent corrosion test.

Nowosielski and Pilarczyk studied the influence of chemical composition and time of high-energy milling for the average diameter of particles as well as grains of powder of Fe-C alloy. They used X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and laser method for distribution of particle sizes.

Saiki *et al.* studied the deformation conditions of epoxy compounds for semiconductor integrated circuits. The specimens were moulded and subjected to tensile testing to examine their constitutive equations. Various characteristics obtained in the tensile test were reasonably represented using a simple model in which a three-element viscoelastic model is connected in series with conventionally used viscoplastic elements.

Schindler *et al.* studied the deformation behaviour and microstructure development of a high-carbon steel 1 CS67 during its hot and cold processing. The ferrite grain size is affected more by the casting's cooling rate and subsequent heating time than by the phase transformations before rolling. Owing to the higher ferrite content resulting from the finer austenite grain size, specimens obtained after laboratory remelting and casting are characterised by lower yield stress and tensile strength, in combination with higher ductility.

Žitnansky *et al.* determined the properties of Ti64 alloy made by non-conventional casting method obtained by the Rapid Prototyping Method. The electron beam and a special equipment were used as heating sources for melting alloy. The mechanical properties of casting materials were verified by toughness, hardness and microstructure analysis. The results obtained from experimental analysis materials were compared by conventional processes with mechanical and microstructure properties. The results showed that procedure used for non-conventional casting is suitable for production of shape-complicated parts.

Special thanks are due to the authors who contributed their papers to this special issue titled 'Materials and manufacturing of the IJMMP', which is the result of the very critical work of reviewers and the authors. It can be said that the papers indeed satisfy high standards of quality. I wish to also thank Professor Leszek A. Dobrzanski for his willingness to select and review the conference papers.

I sincerely hope that the papers presented in this special issue will be valuable sources of information to researchers in various scientific fields, and users in the fields of materials and production.