
Editorial

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The second special issue includes papers on plant oils and their oxidising and quenching capacities and those on various applications of quenching agents, with particular regard to hardening of carbonitrided parts. Studies of metallurgical changes in high-carbon steel in quenching in CMC polymeric water solutions are very important. Virtual quenching permits simulation of a quenching process, estimation of a heat flow at the surface and prediction of the cooling process described by cooling curves, which is often confirmed also by temperature measurements. Such a computer aid makes it possible to predict the variations of hardness and residual stresses, if occurring.

Results of heat treatment and surface engineering are most often presented as a microstructure analysis supported by a microchemical analysis. Both types of analysis are a basis for:

- understanding of volume changes of a machine part and possible distortion
- knowledge of the size and variation of hardness and residual stresses in the surface layer
- the occurrence of cracks in the machine part after heat treatment.

The volume changes after heat treatment can be expected and can, therefore, be taken into account in the production of the machine part, so that the machine part concerned will be produced in the size that will provide, after heat treatment, the right size and no distortion. Two papers deal with a change of size of cylindrical specimens after quenching of different steels on the basis of experiments and appropriate calculations. Gas quenching was carried out with a tool having decreased nozzles, a regulation of mass flow rate, and a constant gas flow rate, which provided different cooling conditions.

A comparison of experimental results is provided by the calculations performed with a program package, Computational-Fluid-Dynamic 'Fluent'. The second paper treats the results of investigations of quenching a ring and a cylinder. They are treated using CFD simulation and FEM simulation with reference to quenching conditions such as flow rate (CFD), varying of the heat transfer coefficient (CFD), temperature distribution in the cylinder (FEM) and distortion (FEM). The experimental part consists of measuring respective deviations of the outer diameters of the cylinder and of the inner and outer diameters of the ring. There is also another paper on the measurement of residual stresses occurring after quenching of specimens with a quadratic cross section with polymeric water solutions. Quenching of the specimens with different quadratic cross sections, i.e., with different masses, was performed from different temperatures, i.e., from the austenitising temperatures and also from the temperatures lower than that. A comparison of numerous measurements makes it possible to determine thermal residual stresses and residual stresses due to phase transformations.

Then followed mathematical modelling and mathematical verification of the quenching process applied to stainless steel with a NAVY C-ring. The calculations were performed by means of a commercial program, DEFORM-HT™, which requires adequate thermo-physical properties permitting efficient thermal modelling. A comparison of experimental and calculated results was based on a cooling curve, cooling rate, effective stress, strain, and changes of the gap size of the C-ring.

What is very important is the prediction of hardness in cylindrical parts by means of the suggested computer program for different quenching agents in accordance with Crafts-Lamonte diagrams and Jominy data on through-hardenability, which can be sufficiently transferred also to machine parts similar to the cylindrical ones.

Special thanks are due to the authors contributing their papers to this special issue of the IJMPT. 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 and Ms. Nevenka Majerle, who took care of the coordination among the reviewers and the authors, and prepared the papers for the publication.

Finally, we wish to thank the journal IJMPT and the Editor Professor Dr. Dorgham, who accepted and endorsed our invitation to prepare a special issue. Many thanks are also due to the team of the Inderscience Publishers for the assistance offered in preparing the special issues.

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