



## HRZZ Research Projects (IP-11-2013)

# Optimisation and Modelling of Thermal Processes of Materials

## OMOTPOM

### Cover Page:

- Name of the Principal Investigator (PI): **Božo Smoljan**
- Name of the PI's host institution for the project: **University of Rijeka – Faculty of Engineering**
- Project proposal full title: **Optimisation and modelling of thermal processes of materials**
- Project proposal duration in months: 48

### Project proposal summary

Phenomena of physical processes during the thermal processes will be investigated. Methods for modeling and computer simulations of thermal processes of materials will be developed. Thermal processes, such as heat treating processes of steel, hot pressing of powder metals and casting of alloys of light metals will also be investigated. The study of heat treatment of steel will be focused on quench hardening and tempering, and control cooling during the hot working and steel casting. Thermal stability of electro-active composites will be analyzed. Optimization of electro-less Ni-P coating of stainless steel and thermo-diffusive heat treatment of layers will be studied. Methods of optimization of application of tools and dies in thermal processing of materials will be studied. Models and computer programs for simulation of behavior of steel dies during casting of light metal alloys and hot pressing of metal powders will be developed.

During the thermal processes physical processes and material properties such as: heat transfer, microstructure transformations, mechanical properties and distortions and residual stresses will primarily be studied. Numerical model of physical phenomena will be based on finite volume method (FVM). To solve these tasks, joined thermo-mechanic-metallurgical approach will be required. The computer program for 3-D simulation of heat transfer, microstructure transformations, mechanical properties, distortions and residual stresses during the thermal processes will be developed.

**Team members**

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**Selected results**

B. Smoljan, D. Iljkić, S. Smokvina Hanza, *Computer simulation of mechanical properties of quenched and tempered stamping punch*, Proceedings of the European Conference on Heat Treatment 2015 and the 22nd IFHTSE Congress – Heat Treatment and Surface Engineering – From tradition to innovation, 20-22 May 2015, Venice, Italy

B. Smoljan, D. Iljkić, L. Pomenić, *Mathematical modelling and computer simulation of steel quenching*, Proceedings of the 24th International Conference on Metallurgy and Materials, 3-5 June 2015, Brno, Czech Republic

B. Smoljan, *Quench Processing: Multiple*, Encyclopedia of Iron, Steel, and Their Alloys, 2015, DOI: 10.1081/E-EISA-120051101

B. Smoljan, D. Iljkić, G.E. Totten, *Mathematical Modeling and Simulation of Hardness of Quenched and Tempered Steel*, Metallurgical and Materials Transactions B, 2015, DOI: 10.1007/s11663-015-0451-6