New Tool Steel treatment technology is bringing the following benefits:

- removing hard polyhedral grains of Cr (chromium carbides) from high-alloyed tool steels through semi-solid processing;
- no reduction of the steel toughness;
- increasing steel hardness up to approximately 800 HV10;
- high stability of the resulting structure, achieved by changing the cooling strategies;
- using conventional and commonly available equipment, usually already available in the process. The technology uses different heating and cooling process with same equipment.

**Technology Innovation**

By using this semi-solid state processing technology, a fine-grained microstructure without large polyhedral carbides can be obtained, while changing the morphology of carbides so that they are not uniformly dispersed, which contributes to the structure strengthening. In addition, the sub-microns are 0.5 μm in size and they do not reduce the toughness of the steel. The resulting hardness of the material reaches approximately 800 HV10, compared to a conventional processing, where the hardness reaches 500 HV10. Whole process is implemented with use of conventional, thus commonly available technological equipment.
UNCONVENTIONAL TECHNOLOGY OF TOOL STEEL THERMOMECHANICAL TREATMENT

TARGET APPLICATION
Tool steels with better parameters, using standard steels at input, processed on currently available equipment.

TYPICAL USER
The technology is targeted at tool steel producers.

WE OFFER
Technology licensing for implementation at the tool steel production lines. Technology testing, its setting for specific production volumes and possible further cooperation on technology improvements.

INTRODUCTION THE TECHNOLOGY INTO PRODUCTION
As a research organization, we offer technology licensing for the manufacturing enterprises, including co-operation in setting up the technology for production, final product verification and further cooperation in the expansion of technology. Technology state and known risks:

• Technology tested on X210Cr12 steels, the final toughness and hardness verified.

• The team does not know about use of similar technology in production, technology was accidentally developed in the research of semi-solid processing.

• Technology principal risks are not known, adjusting would be required with respect to production volumes.

Typical processing line configuration, tested on X210Cr12 steels

1. Furnace - operating temperature 1250°C - 1300°C, heating of material to semi-solid state, dissolution of primary carbides.

2. Furnace - operating temperature up to 1100°C, or cooling bath and furnace (according to the dimensions of the product produced). Cooling to the forming temperature. Resulting in grains of austenite surrounded by carbide mesh.

3. Forming equipment, press, forging equipment, rolling mill - hot forming, redistribution of carbides from net to volume. In subsequent heat treatment, the carbides are discharged from the supersaturated solution into submicron carbides.

All devices can be used in common configurations
It is therefore not necessary to produce tailor-made special equipment.