

## Methodology for observation of maraging tool steel after 3D printing using FIB and STEM mode

### Corresponding author:

Kateřina Opatová, opatovak@rti.zcu.cz, University of West Bohemia, Regional Technological Institute

### Co-authors:

Ludmila Kučerová, Ivana Zetková

### Abstract:

The components of the maraging tool steel produced by 3D printing are further heat-treated after printing. It is a stress relief annealing and precipitation hardening since it is martensitic precipitation-hardenable steel. During this process, in the steel microstructure, precipitates of Ni<sub>3</sub>Ti and Fe<sub>2</sub>Mo or Fe<sub>7</sub>Mo are formed, which significantly contribute to an increase in ultimate tensile strength, hardness, and toughness. To understand the precipitation processes, it is necessary to describe the particles in detail. However, they are very small in size and cannot be examined properly by a light microscope (LM) or by scanning electron microscope (SEM). A possible way to investigate and describe these precipitates is to produce a thin lamella using a focused ion beam (FIB) in the electron microscope chamber, where scanning transmission electron microscopy (STEM) is subsequently used for observation. A lamella was prepared from the DMLS (Direct Metal Laser Sintering) printed part by an ion beam for observation in STEM mode. The experiment took place at the Zeiss AURIGA scanning electron microscope, equipped with an ion gun and also provided with STEM capabilities for thin samples. The lamella preparation methodology was gradually optimized to achieve sufficient resolution during observation of these very fine microstructures produced by 3D printing.

### Key words:

FIB, STEM, maraging steel, 3D printing