Multiphysical Simulation of the Material State with Consideration of Process Parameters in a Single-Screw Extruder

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INTRODUCTION:

▪COMSOL Multiphysics® for process simulation in polymer technology
▪First step: Simulation and analysis of the material state in the extrusion process
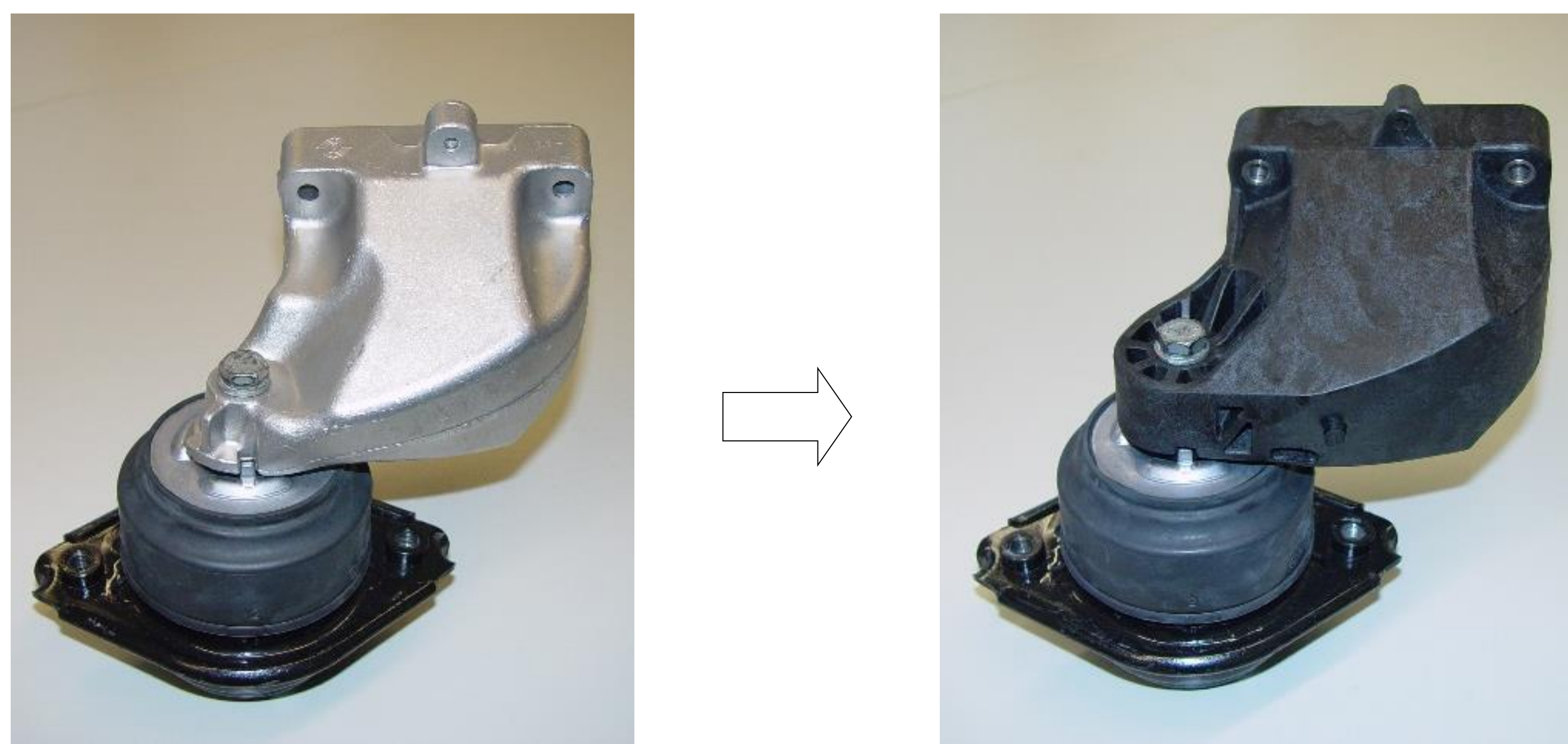▪Objective: Optimization of the injection molding process for better component quality (e.g. Engine bracket)

Figure 1. Substitution from aluminum- to plastic material in engine bracket

COMPUTATIONAL METHODS:

- Simulation of the material state in the single screw extruder
- In consideration of the mechanical and thermodynamical influences
- Applied COMSOL Multiphysics® interface: Rotating Machinery with Nonisothermal Flow
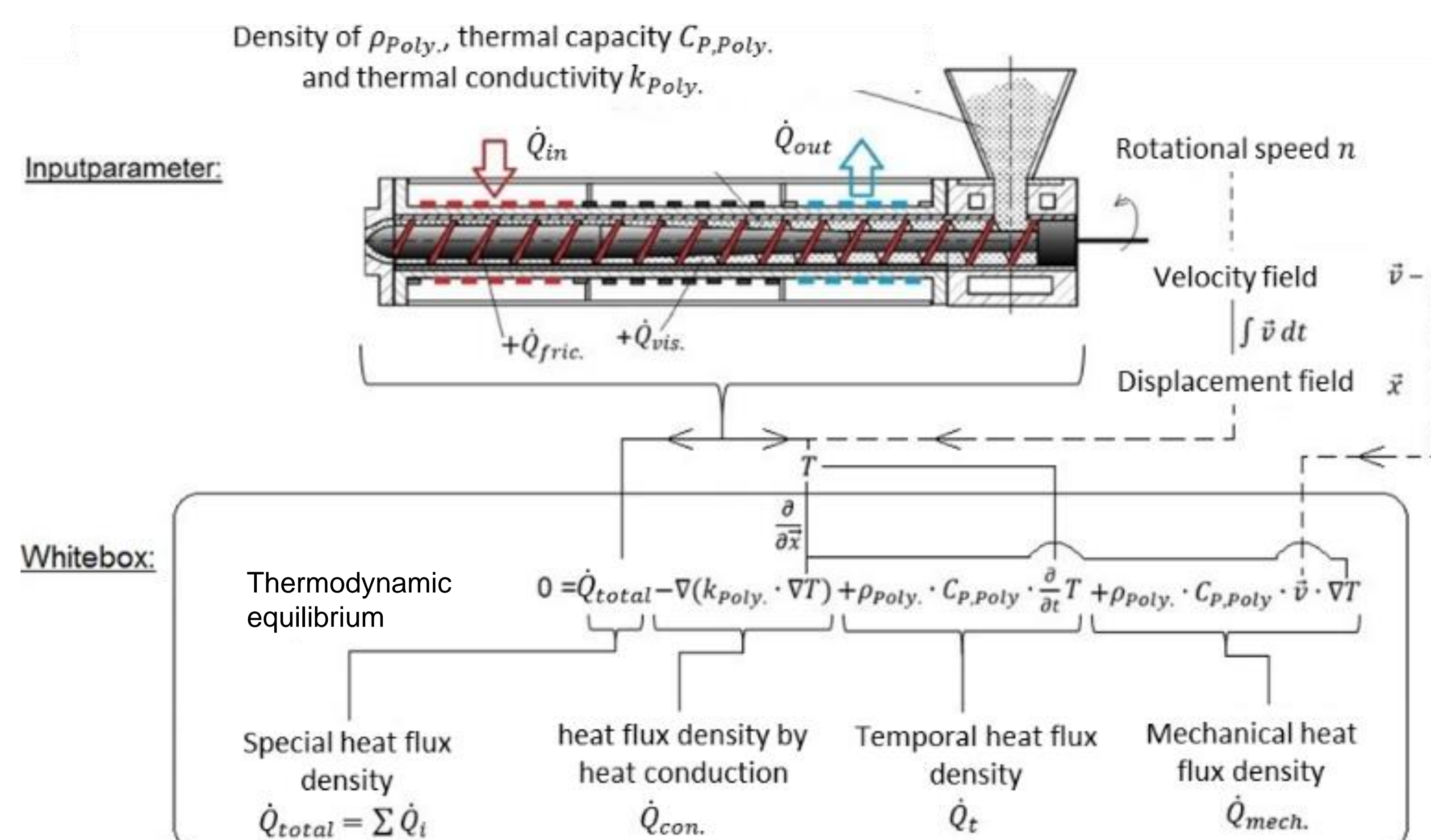

Figure 2. e.g. Thermodynamic equilibrium

RESULTS:

Different material states along the extruder screw as distribution of:
- Temperature
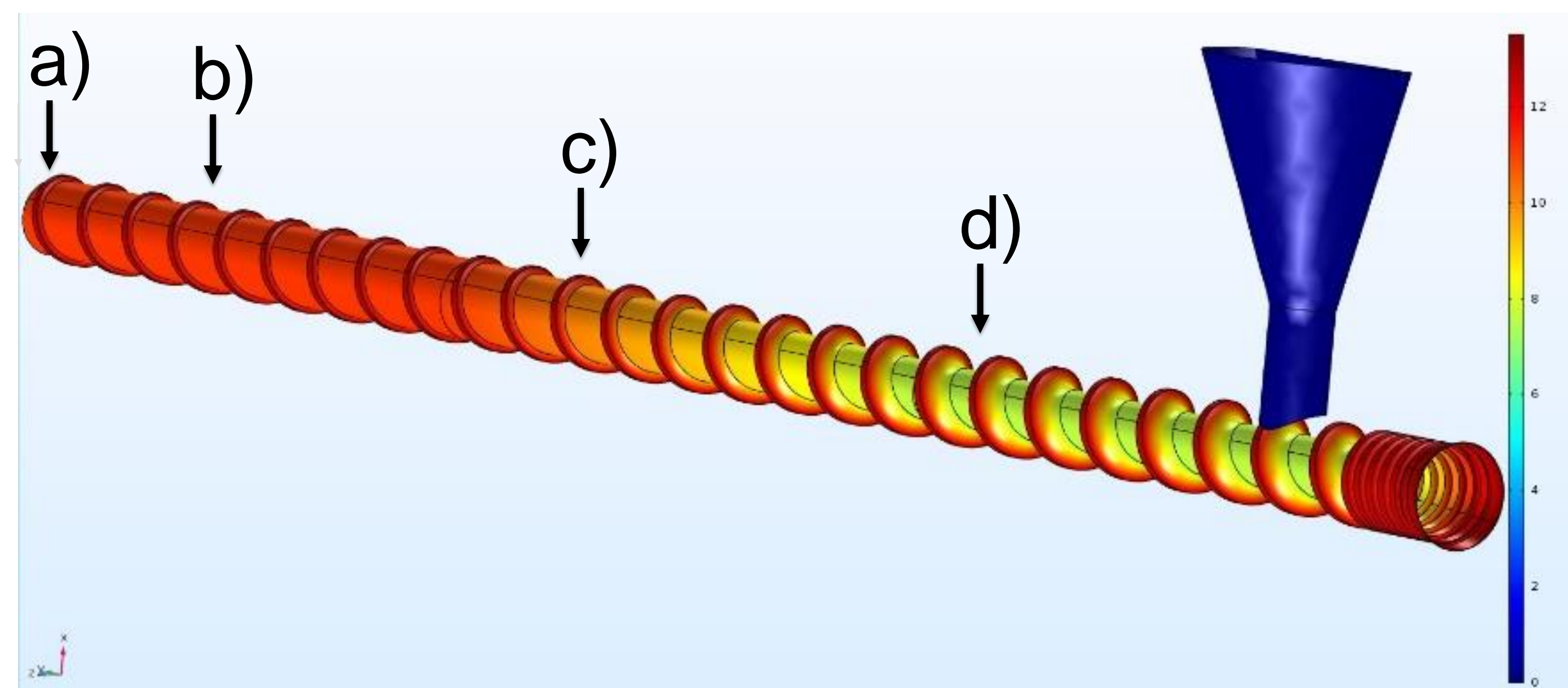- Density
- Pressure
- Viscosity

Figure 3. Contour plot of Temperature along the screw axis in the extruder
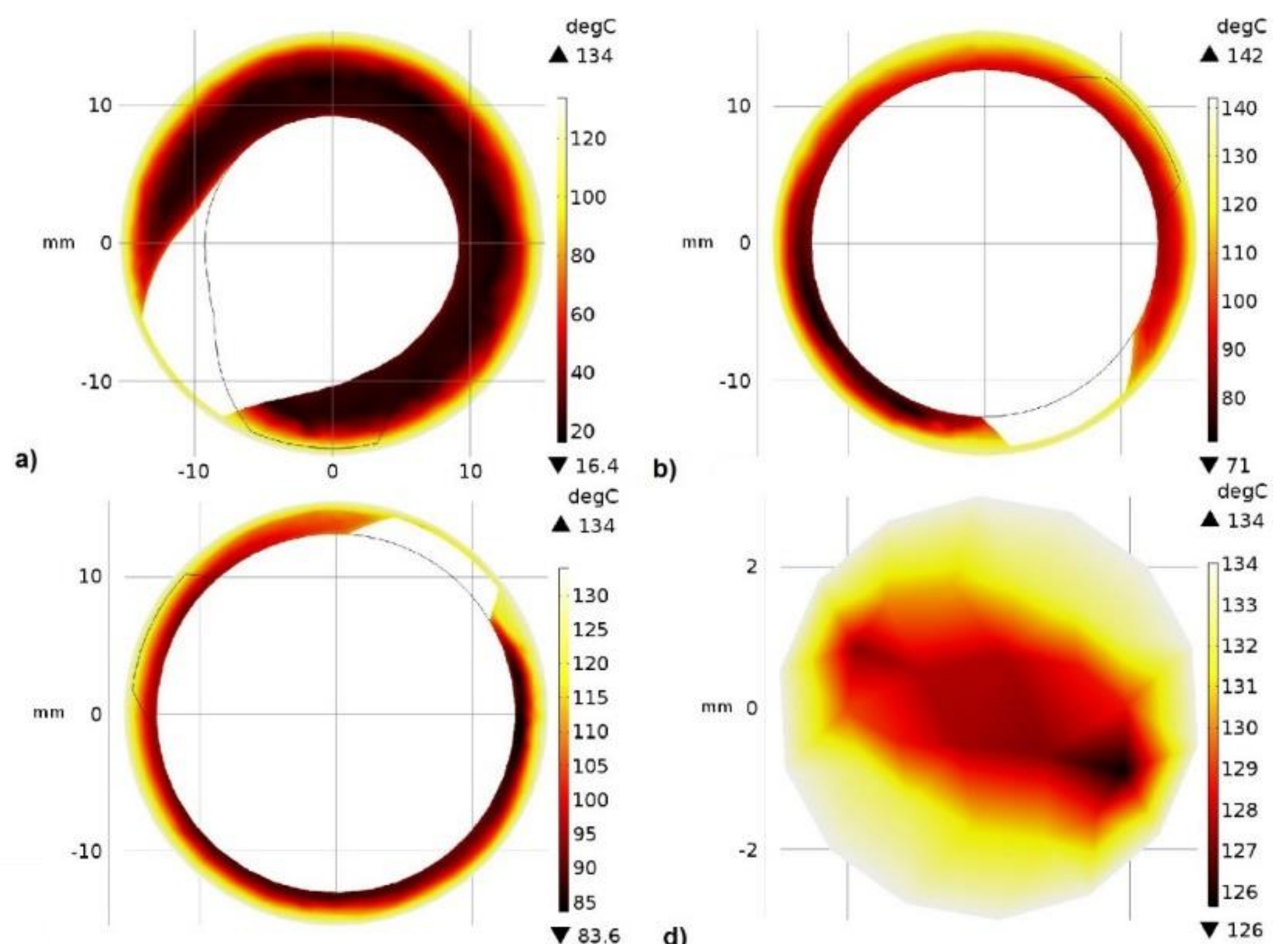

Figure 4. e.g. Temperature distribution in different cross-sections a)-d)

CONCLUSIONS:

- COMSOL Multiphysics® is applicable for simulation of the material states in the extrusion process.
- A good correspondence between experiment and simulation in the single-screw extruder is achieved.