Introduction:
• Plasma electrolytic polishing (PeP) is an electrochemical method for surface treatment.
• PeP is a special case of anodic dissolution [1] that unlike electrochemical polishing requires higher voltage and uses environment friendly aqueous solutions of salts.
• A principle scheme of the PeP process is shown in Figure 1.
• To investigate the basics of PeP a transient 2D simulation model was developed.
• Model geometry and boundary conditions are based on principle scheme shown in Figure 1 and provided in Figure 2.
• In this model, a special interest is focused on the plasma-gas layer and the electric potential.

Computational Methods:
• The simulation has two studies: stationary study and time depended study.
• Stationary study is used to calculate initial values for electrical variables.
• Time depended study is used to solve electric currents physics and mesh deformation.
• Material removal is realised as a function of the current density at the workpiece surface.

Results
• Almost total voltage drops inside plasma-gas layer (Figure 3).
• In Figure 4 it can be seen, that the normal current density in the cavities is lower than at the peaks.
• In Figure 4 it also can be seen that at the current density at the deeper cavities raises with the processing time.
• To analyse the polishing effect, the roughness parameter Ra was calculated.
• The roughness decreases according to exponential decay (Figure 5).
• The minimal achievable roughness Ra in this model has a value equals 0.84 μm.
• MRR in this model is 3 μm/min.
• Based on this model it can be concluded, that PeP of stainless steel can be simulated as an electrochemical machining process.

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