

Multiphysics In Electron Beam Simulation

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Abstract

ALD Vacuum Technologies GmbH has been using COMSOL Multiphysics® since 2020. Our machines use an electron beam system to provide the required process heat. Multiple physical aspects of this electron beam system are simulated in COMSOL Multiphysics®.

Strong alternating currents run through a filament, heating it up to some thousand degrees celsius to the temperature determined region of free electron generation. The emerging electron cloud is accelerated by a high voltage field of some kilovolts, heating the secondary cathode. The secondary cathode has direct current supply and generates the main electron beam using high voltage acceleration of some tens kilovolts. Space charge effects of the intense electron beam are compensated by ionized residual gas.

This obvious complex physical problem involves mechanical physics, temperature expansion, temperature distribution, heat conduction, current heating and current conduction.

This talk will give a short introduction on how individual physical aspects are implemented in the COMSOL® simulation and an overview of the intense using of multiphysics dependencies in COMSOL®.