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Detailed Modeling of Physical Processes in Electron Sources for Accelerator Applications[1] OKSANA CHUBENKO, ANDREI AFANASEV, Department of Physics, The George Washington University, 725 21st St. NW, Washington, DC 20052, USA — At present, electron sources are essential in a wide range of applications – from common technical use to exploring the nature of matter. Depending on the application requirements, different methods and materials are used to generate electrons. State-of-the-art accelerator applications set a number of often-conflicting requirements for electron sources (e.g., quantum efficiency vs. polarization, current density vs. lifetime, etc). Development of advanced electron sources includes modeling and design of cathodes, material growth, fabrication of cathodes, and cathode testing. The detailed simulation and modeling of physical processes is required in order to shed light on the exact mechanisms of electron emission and to develop new-generation electron sources with optimized efficiency. The purpose of the present work is to study physical processes in advanced electron sources and develop scientific tools, which could be used to predict electron emission from novel nano-structured materials. In particular, the area of interest includes bulk/superlattice gallium arsenide (bulk/SL GaAs) photo-emitters and nitrogen-incorporated ultrananocrystalline diamond ((N)UNCD) photo/field-emitters.

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