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Plasma Modeling Enabled Technology Development Empowered by Fundamental Scattering Data[1]

MARK J. KUSHNER, University of Michigan

Technology development increasingly relies on modeling to speed the innovation cycle. This is particularly true for systems using low temperature plasmas (LTPs) and their role in enabling energy efficient processes with minimal environmental impact. In the innovation cycle, LTP modeling supports investigation of fundamental processes that seed the cycle, optimization of newly developed technologies, and prediction of performance of unbuilt systems for new applications. Although proof-of-principle modeling may be performed for idealized systems in simple gases, technology development must address physically complex systems that use complex gas mixtures that now may be multi-phase (e.g., in contact with liquids). The variety of fundamental electron and ion scattering, and radiation transport data (FSRD) required for this modeling increases as the innovation cycle progresses, while the accuracy required of that data depends on the intended outcome. In all cases, the fidelity, depth and impact of the modeling depends on the availability of FSRD. Modeling and technology development are, in fact, empowered by the availability and robustness of FSRD. In this talk, examples of the impact of and requirements for FSRD in the innovation cycle enabled by plasma modeling will be discussed using results from multidimensional and global models. Examples of fundamental studies and technology optimization will focus on microelectronics fabrication and on optically pumped lasers. Modeling of systems as yet unbuilt will address the interaction of atmospheric pressure plasmas with liquids.

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