

EUV Resists: Chemistry, Mechanisms and Challenges

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The lithography community has studied EUV photoresists for nearly thirty years. Yet, some of the most basic details of the interaction of EUV photons with photoresists remain poorly understood. In a typical photochemical reaction using longer-wavelength light ($\lambda = 157\text{-}1000\text{ nm}$), photons create excited states in photoactive compounds, thereby creating known quantities of intermediates and photoproducts at measurable rates. The photochemical reactions occurring during EUV exposure are much more complex and, as yet, not fully explored.

This presentation will start with a quick introduction to photoresists and EUV lithography. It then will describe how 92 eV EUV photons ionize molecules in resists, creating holes and free electrons, and identify and discuss the individual interactions that occur with atoms (Figure 1). However, the number of electrons created, their reaction mechanisms, their lifetimes and their reaction cross-sections are not well known. The presentation will discuss experimental results and provide insight into these poorly understood aspects of EUV exposure mechanisms.

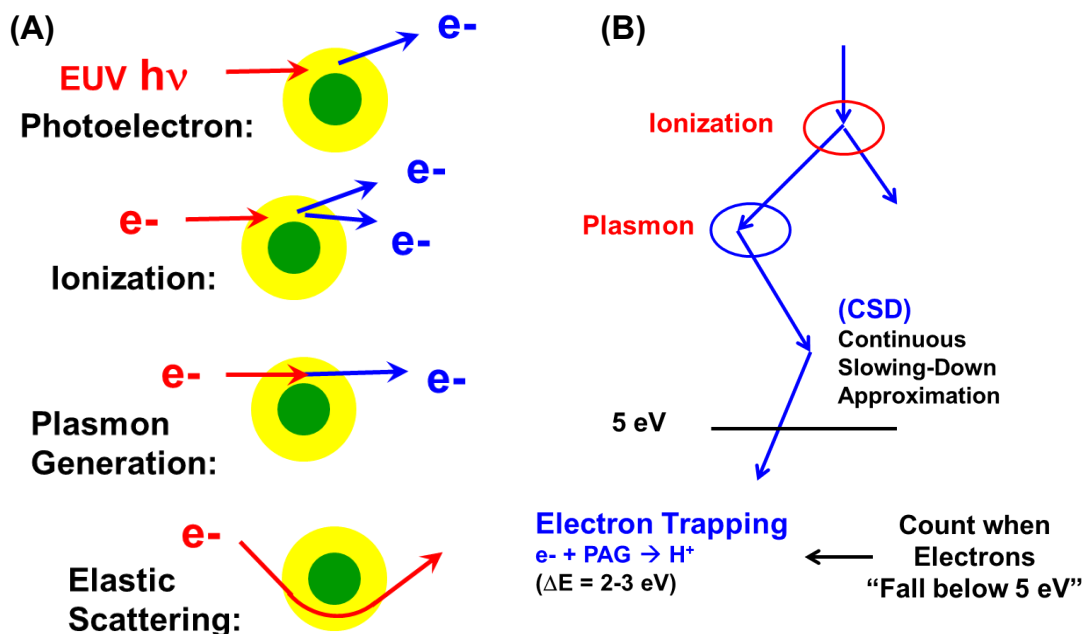


Figure 1: (A) Basic physical events occurring during EUV exposure. (B) Comparing experiment and modeling.

Bio for Robert Brainard

Robert Brainard received his B.S. in Chemistry from U.C. Berkeley. He studied the reaction mechanisms of organoplatinum compounds during his graduate studies with Professor Whitesides at MIT and Harvard University. After receiving his Ph.D., he studied the reaction mechanisms on copper and silver surfaces under ultrahigh vacuum conditions as a post-doctoral student with Professor Madix at Stanford University.



Robert worked for Polaroid 1987-1990 and worked at Shipley/Rohm & Haas 1990-2005, where he did product development research in the areas of: electrodeposited, dielectric, color filters, DUV, EUV, X-ray and e-beam photoresists. Robert was the first chemist in the world to design resists for EUVL, starting in 1998 while working at Shipley Company and in collaboration with the EUV LLC.

Robert is now a tenured Professor at the Department of Nanoscale Science and Engineering within the University at Albany investigating new materials for use in EUV lithography and biological applications. His specific research interests include:

- EUV photoresist exposure mechanisms.
- High quantum efficiency EUV photoresists.
- Design and synthesis of photoacid generators.
- Acid amplifiers for use in EUV lithography.
- Design and synthesis of photoimageable hydrogels for cell growth.
- Molecular Organometallic Resists for EUV (MORE).