Can Acid Amplifiers Help Beat the RLS Trade-Off?

Seth Kruger, Craig Higgins, Srividya Revuru, Robert L. Brainard
College of Nanoscale Science and Engineering, University at Albany, NY 12203

Sarah Gibbons, Dan Freedman
State University of New York at New Paltz

Wang Yueh and Todd R. Younkin
Intel Corporation, Hillsboro, OR 97124

One challenge posed to Extreme Ultraviolet (EUV) resists is the simultaneous inprovement of resolution, line-edge roughness (LER), and sensitivity, commonly refered to as the RLS trade-off.[1] We have predicted that the best way to beat the RLS trade-off is to create more acid molecules per absorbed photon.[2] One method of increasing the amount of acid is through the use of an acid amplification scheme. Acid amplifiers (AA's) are compounds that decompose in the presence of acid to generate more acid. This kind of decomposition kinetics is called autocatalysis (Figure 1).[3]

We have synthesized and lithographically evaluated over twenty new acid amplifiers, specifically designed for use in EUV resists. Figure 2 shows that the use of AA's can increase the sensitivity of an EUV resist by 5 – 10x. The question remains, however, if the AA's can improve sensitivity without degrading the LER or impacting the ultimate resolution of an EUV resist platform.

In this paper, we explicitly describe the structures of several new acid amplifiers and EUV resist formulations prepared from them. We make direct comparisions between resolution, LER and sensitivity using two common RLS analysis techniques -- K_{LUP}[4] and Z-Factor[5].

References.

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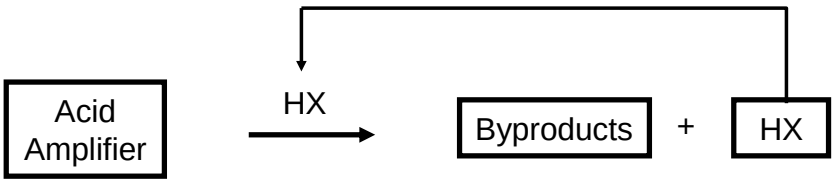

Figure 1. Generic scheme showing acid amplifier decomposition by an autocatalysis mechanism.

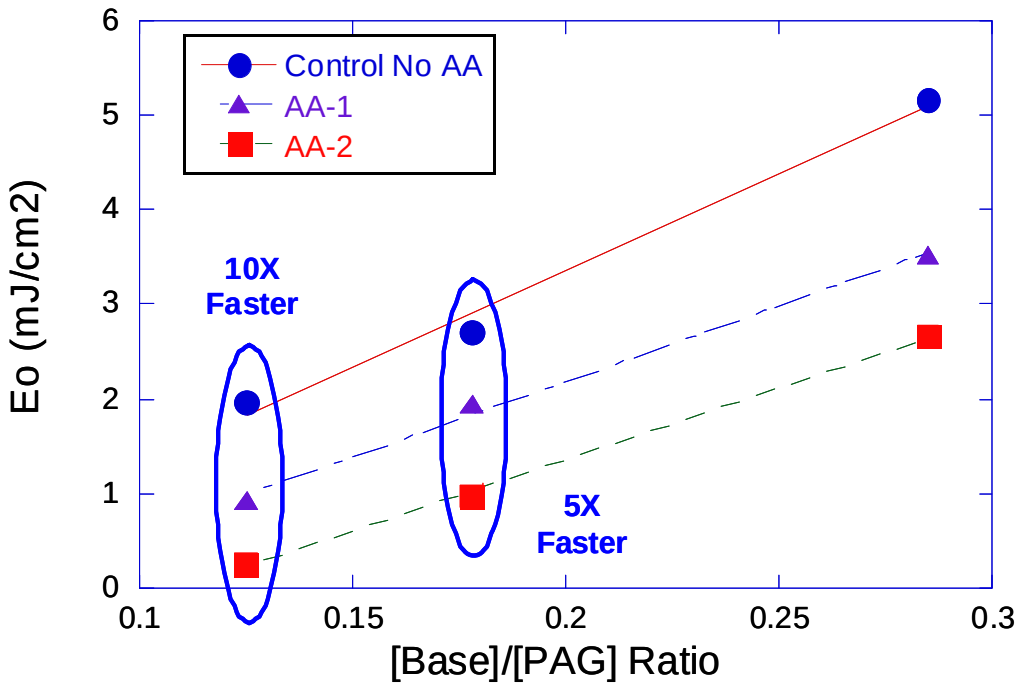

Figure 2. EUV clearing dose (E_0, mJ/cm^2) *vs.* [Base]/[PAG] ratio for three resist families: ESCAP Resist Control (No added acid amplifier); Control Resist + 7.5 wt% acid amplifier 1 (AA-1); Control Resist + 8.8 wt% acid amplifier 2 (AA-2).