

An Investigation of CSAR 62, a New Resist for Electron Beam Lithography

S. Thoms and D. S. Macintyre

*School of Engineering, University of Glasgow, Glasgow, UK, G12 8LT
stephen.thoms@glasgow.ac.uk*

Historically the available electron probe size has always been smaller than the resolution of polymeric resists. As a consequence, advances in electron beam lithographic resolution and pattern transfer capability have mainly arisen from improvements in resist performance. CSAR 62, manufactured by Allresist GmbH, is a new positive tone electron beam resist designed to have similar performance to ZEP 520A in resolution, speed and etch resistance. In this paper we investigate its performance as compared with ZEP 520A and polymethyl methacrylate (PMMA).

We used a Vistec VB6 electron beam tool operated at 100 kV to pattern the three resists on various substrates. Reactive ion etching was then used to transfer the pattern into SiO₂ and GaAs. The developed resist on silicon and the etched structures in SiO₂ and GaAs were inspected by electron microscopy. The developers used were amyl acetate for CSAR 62, xylene for ZEP 520A and 2.5:1 isopropyl alcohol : methyl isobutylketone for PMMA.

Prior to etching we were able to pattern 40 nm period gratings in ZEP 520A and 50 nm period using CSAR 62. However after etching 200 nm into GaAs, using a SiCl₄ based process, the best we were able to achieve with both resists was 50 nm. Figures 1 and 2 show 50 nm period gratings in GaAs patterned using CSAR 62 and ZEP 520A respectively; the resist has been removed with an oxygen plasma clean. The PMMA resist did not survive the etch process. The line doses were 0.44 and 0.53 nC/cm for CSAR 62 and ZEP 520A respectively. The etch ratios of CSAR 62 and ZEP 520A to the bulk GaAs substrate were 4.9 and 6.5 respectively. When etching SiO₂ using a CHF₃/Ar mixture, the etch ratios of the resists to SiO₂ were 11 and 8 for CSAR 62 and ZEP 520A. Both these resists can be seen to have similar lithography and etch characteristics.

Figure 3 shows contrast curves for the three resists. The contrast for CSAR 62, ZEP 520A and PMMA was measured to be 5.2, 4.8 and 2.7 respectively, and it can be seen that CSAR 62 is the most sensitive resist under these conditions. Further resist development and pattern transfer issues will be discussed in the paper.

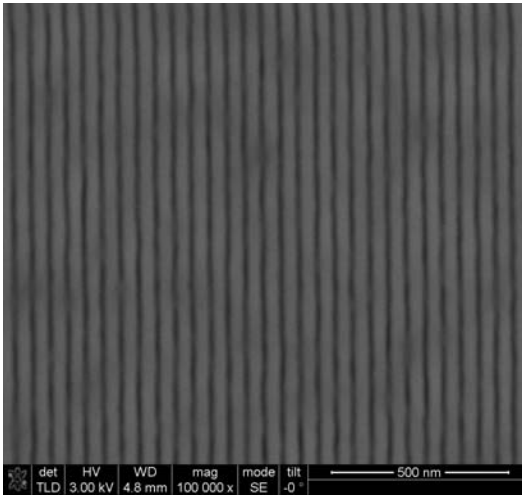


Figure 1: 50 nm period grating etched into GaAs using ZEP 520A as the mask.

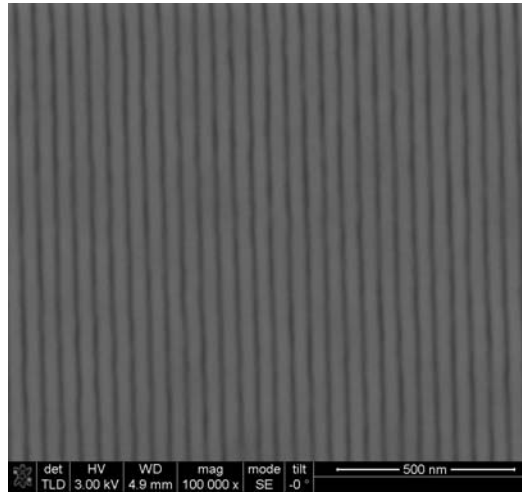


Figure 2: 50 nm period grating etched into GaAs using CSAR 62 as the mask.

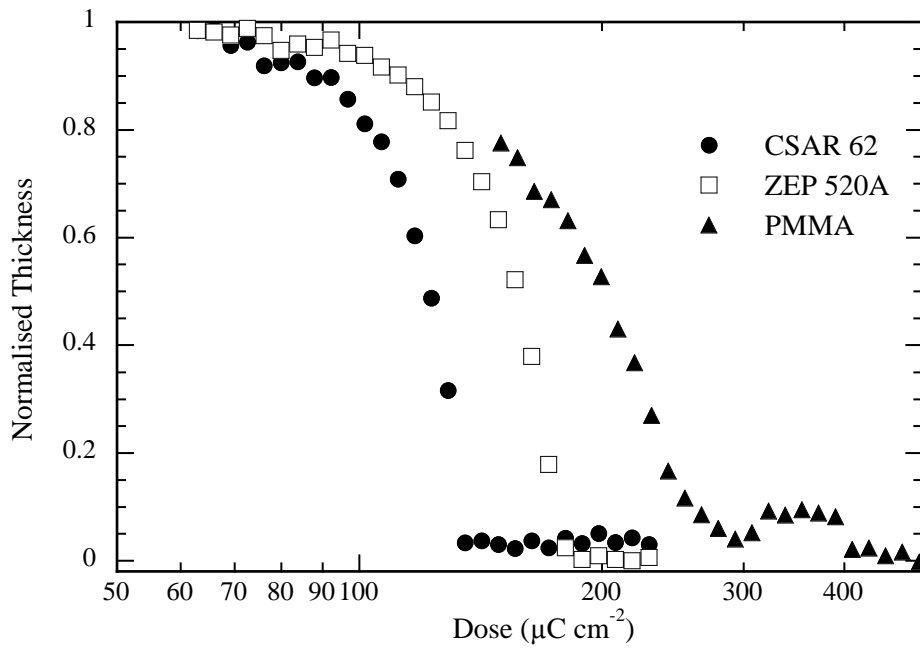


Figure 3: Contrast curves for 200 nm thick CSAR 62, ZEP 520A and PMMA resists.