300 mm E-Beam Lithography

CNF Project Number: 2931-21

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Primary CNF Tools Used: JEOL 9500

Abstract:

We require small capacitors on 300 mm oxidized silicon wafers for SEM applications. To fabricate these capacitors, we used the JEOL 9500 system to pattern small (~50nm) features for subsequent metallization and liftoff.

Summary of Research:

Two wafers were coated with a bilayer electron-beam resist and patterned with a 9-die dose array on the JEOL 9500. The wafer was then developed and removed from the CNF for plasma descum, metallization, and liftoff elsewhere.

None of the 50 nm critical features were resolved at any of the attempted nine electron beam doses. An example site of a 50 nm feature is shown in Figure 1. Further, many of the larger features exhibited loss of adhesion, as shown in Figure 2.

Conclusions and Future Steps:

We hypothesize that the bottom layer of electron-beam resist may have been incompletely developed, such that the Cr-Au metallization layer did not adhere well to the underlying oxide. We propose repeating the lithography with a 100 mm oxidized silicon wafer, such that electron microscopy can be performed at the CNF immediately after development to determine if any resist remains in the exposed areas of the wafer.

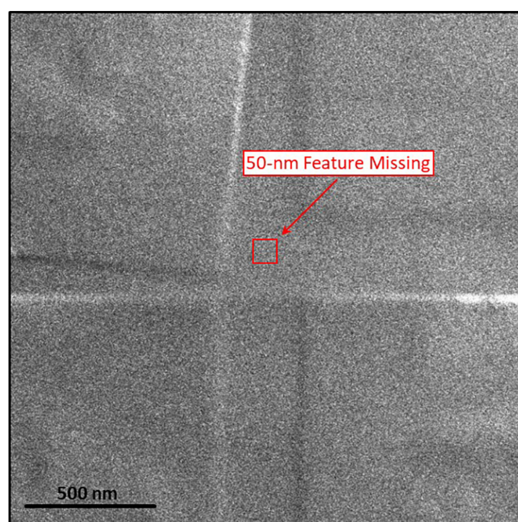

Figure 1: Electron micrograph of the location of a 50 nm critical feature that was not resolved by the electron-beam lithography process.

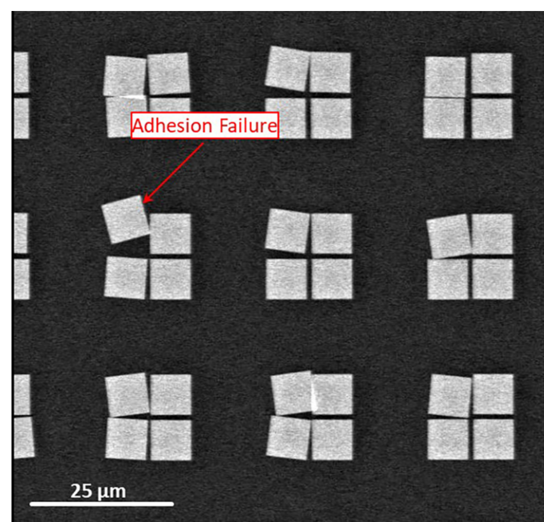

Figure 2: Electron micrograph showing 5 µm features that delaminated from the substrate after liftoff.