

## Reducing Aluminum Corrosion after Etching Aluminum using $\text{Cl}_2$ and $\text{BCl}_3$

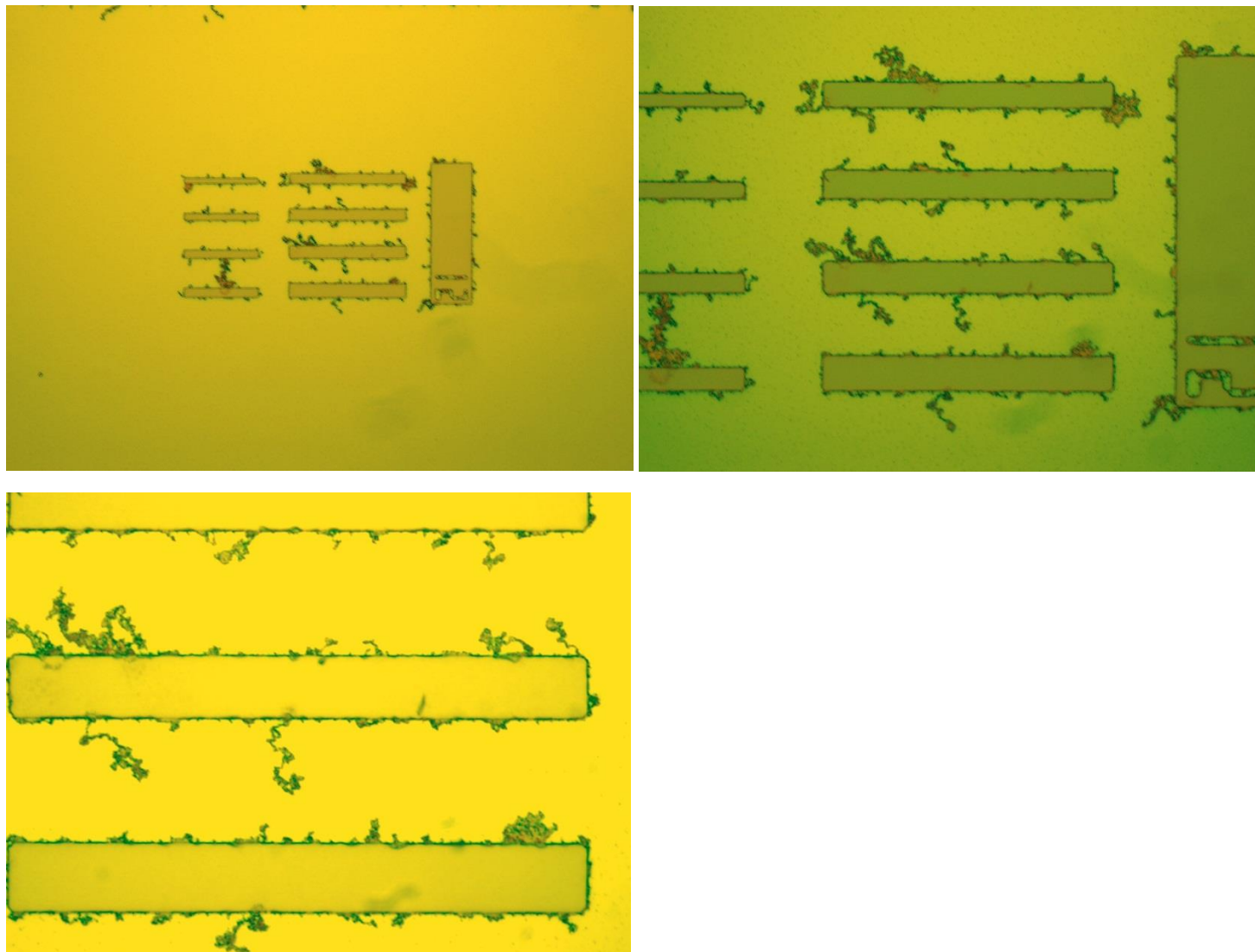
**Introduction:** Aluminum corrosion, which is a chemical reaction of the etch by-products,  $\text{AlCl}_3$ , embedded in the sidewall deposits, with moisture in the air, results in “warm”-like residues, which can be observed under microscope. To reduce this corrosion, one needs to do a following up, in-situ, clean to remove the sidewall deposits, with a small amount of fluorides to convert the corrosive  $\text{AlCl}_3$  to non-corrosive  $\text{AlF}_3$  and some hydrogen to react with the residual chlorides to volatile  $\text{HCl}$ .

### Experimental:

- 1) Sample:  $\text{SiO}_2$  (~300 nm) patterned Al/Ni/Ti on Si
- 2) Etch the top Al film using Panasonic ICP#1 with 0.7 Pa, 70/300 W,  $\text{Cl}_2/\text{BCl}_3=40/20$  sccm, and etch time=80 s.
- 3) Etch the  $\text{SiO}_2$  side-wall deposit with some  $\text{AlCl}_3$  embedded, in-situ (the sample was remained inside of the etch chamber after the Al film etching) using Panasonic ICP#1 with 0.5 Pa, 200/900 W,  $\text{CHF}_3=40$  sccm (1 pa, 50/900 W,  $\text{CHF}_3=40$ sccm, and time=300 s for sample#Ti/Ni/Al06-04; 1 pa, 100/900 W,  $\text{CHF}_3=40$ sccm, and time=300 s for sample#Ti/Ni/Al06-05).
- 4) Put the etched sample into DI water to remove the remaining  $\text{Cl}_2$ .

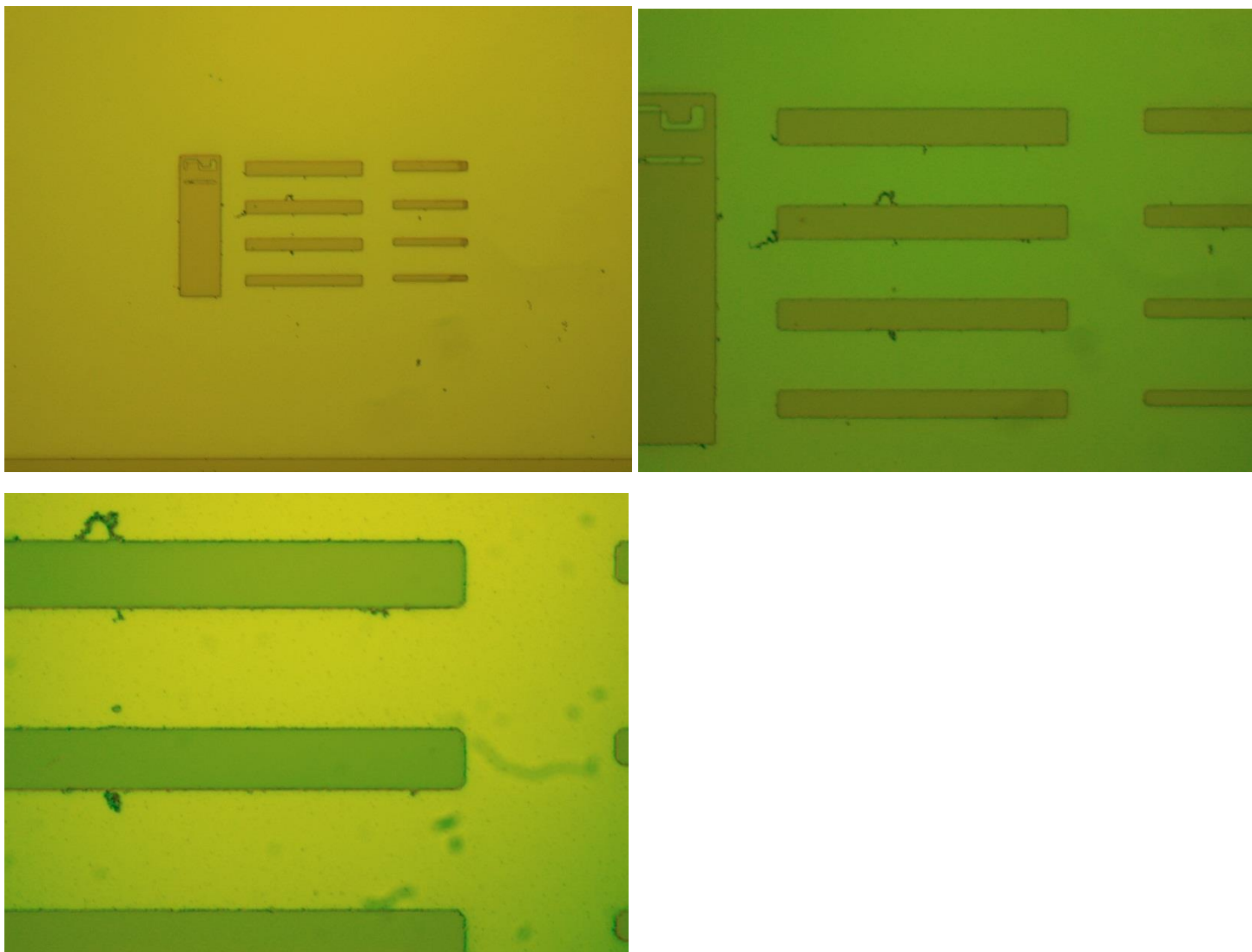
**Results:**

Figure 1 Sample Ti/Ni/Al#06-03: After the Al-film etch (no the following in-situ CHF<sub>3</sub> plasma clean).



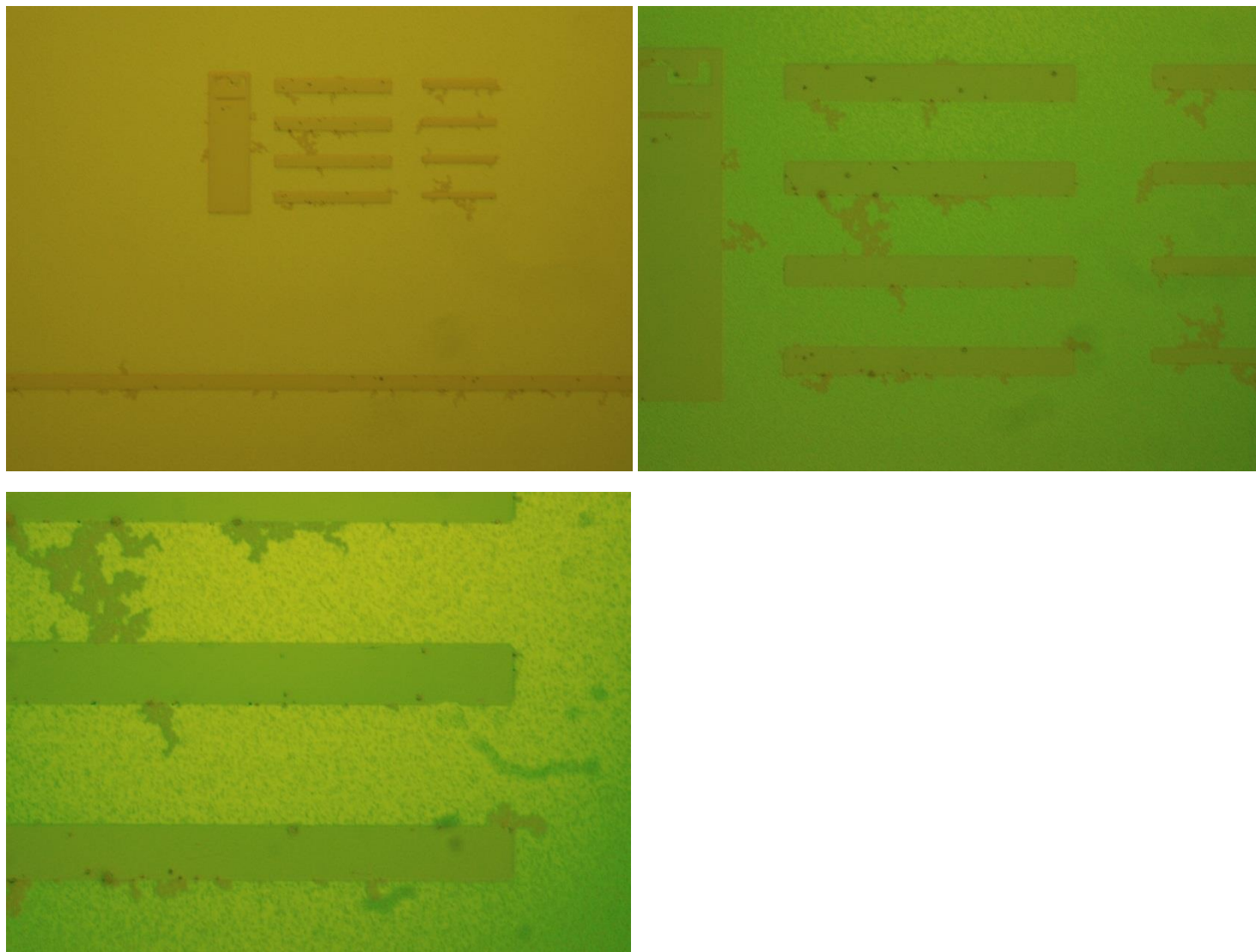
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Figure 2 Sample#Ti/Ni/Al06-01: After the Al-film etch and the following in-situ  $\text{CHF}_3$  plasma clean for 3 minutes.



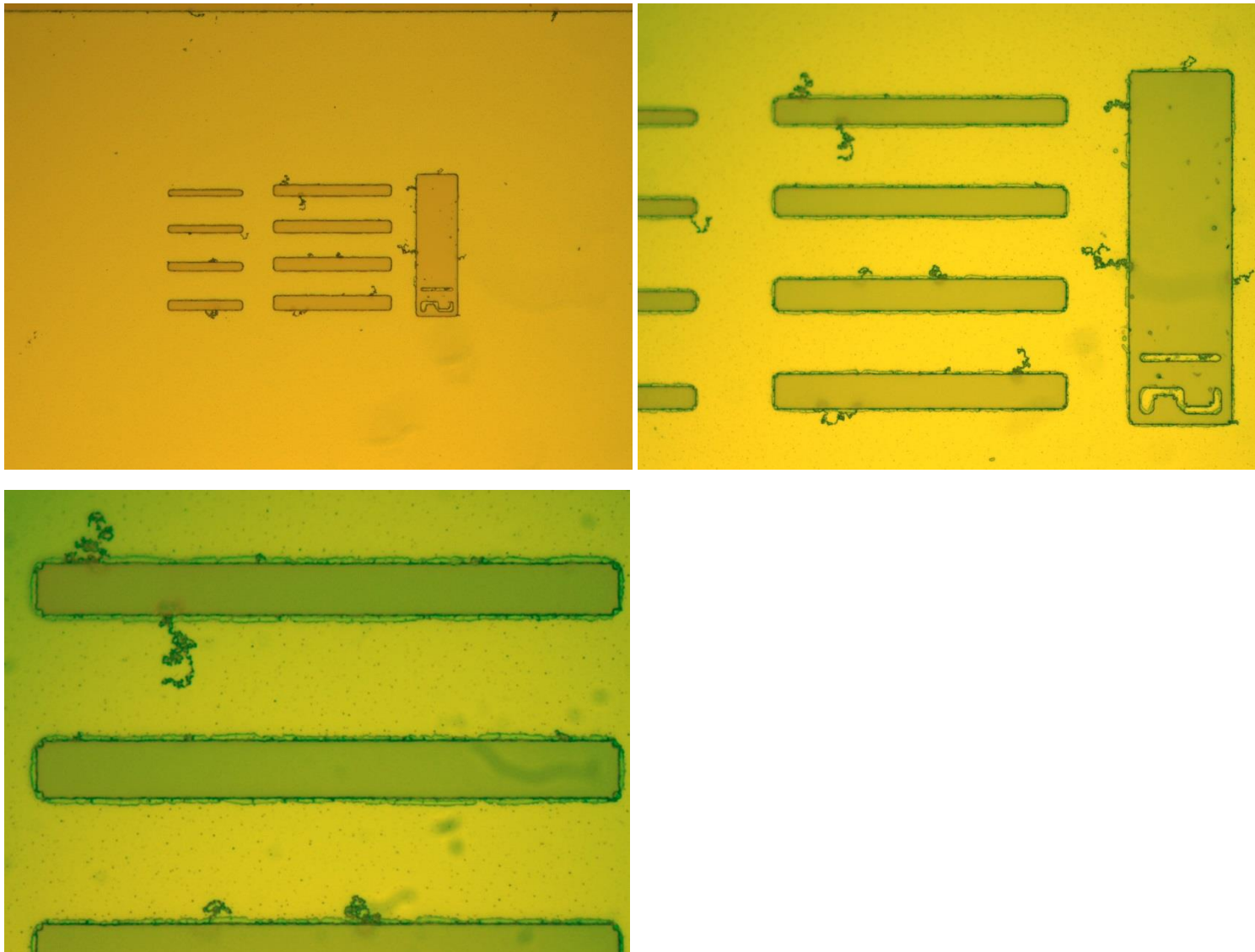
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Figure 3 Sample#Ti/Ni/Al06-02: After the Al-film etch and the following in-situ  $\text{CHF}_3$  plasma clean for 6 minutes.



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Figure 4 Sample#Ti/Ni/Al06-04: After the Al-film etch and the following in-situ  $\text{CHF}_3$  plasma clean (1 Pa, 50/900 W,  $\text{CHF}_3=40\text{sccm}$ ) for 5 minutes.



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Figure 4 Sample#Ti/Ni/Al06-05: After the Al-film etch and the following in-situ  $\text{CHF}_3$  plasma clean (1 Pa, 100/900W,  $\text{CHF}_3=40\text{sccm}$ ) for 5 minutes.

