CD26 photolithography recipe

Short story:

1.) 3-solvent clean: 5 min with ultrasound in TCE, acetone and methanol
2.) Singe on hotplate, 160C for 5min
3.) Spin 1813 photoresist at 5000 rpm for 40s
4.) Bake on hotplate, 115C for 2min
5.) Expose on ABM for 4s
6.) Develop using CD26 for 30-90s
7.) Wash in DI, blow dry
8.) Plasma clean 110W for 30s

Longer Story:

1.) General note about cleaning your chip: Never let a liquid just evaporate because it will leave a residue on your chip which may be conducting. If the chip is to be dried, blow dry the chip with clean gas (nitrogen, helium). If the chip is going back into another liquid, as during the 3-solvent clean, do not blow dry between solvents.
2.) ---
3.) Whether or not to use syringe + filter, glass pipette only, or plastic pipette only, seems to be a matter of taste. No one method seems far and away better and using a filter certainly takes more time, although as the resist becomes thicker (with age) the filters become more useful.
To minimize edge bead, use a 5s spin-up, put plenty of photoresist on during spin-up, and ramp to full speed by pressing the Start pedal as soon as you are done.
4.) You will get better thermal contact if you carefully clean the back of your chip with a Q-tip and acetone, but at the risk of getting acetone on the front of your chip and destroying the photoresist.
5.) ---
6.) Develop about 2/3 of the total time with one beaker of developer and develop the last 1/3 in a second, "fresher" beaker.
You can check how development is going by looking at your chip under a microscope using red light.

Mesa recipe

1.) Photolithography as outlined in photolithography recipe. Make at least one junk chip at the same time so that you can check your etch rate before you consign your device chip to its acid bath.
2.) Use alpha-stepper to get initial measurement of the profile of your chip
3.) Mesa etch: 240:8:1 H_2O:H_2O_2:H_2SO_4; times vary but etch rate ~ 4-5 nm/s. The limit on this rate is probably the concentration of H_2O_2, so if you are using an old bottle, consider changing the ratio above appropriately.
4.) Immediately after etch, dump in DI water for 30s, blow dry
5.) Alpha step again and repeat steps 4,5 if necessary
6.) Wash with acetone 60s, rinse in methanol, blow dry

Ohmics recipe

1.) Photolithography as described in photolithography recipe
2.) Dip with ammonium hydroxide for 2sec, rinse with DI water for >15s
3.) Transport rapidly to evaporator. If you can't evaporate immediately, store in a plastic bag filled with nitrogen to prevent oxidation.
4.) Evaporate ohmics: In theory: 5.0nm Pt, 100.0nm AuGe, 25.0nm Pt, 50.0nm Au; Thicknesses calibrated to Marcus lab e-beam evaporator: 6.25nm Pt, 106.4nm AuGe, 31.25nmPt, 62.5nm Au.
Au and Ge evaporate from the eutectic at different rates, so it may be advisable to add a few grains of fresh AuGe to the boat before each evaporation to keep the proportions constant.
5.) Lift off in acetone with ultrasound and squirts from acetone bottle if necessary (if you care about your chip a lot, leave in acetone at least 1 hour before resorting to ultrasound.) If all else fails, use a Q-tip.
6.) To look at chip "during" liftoff, put some acetone in a fluoroware container, move your chip quickly to the container and look at it under the microscope
7.) Rinse in methanol and blow dry (make sure the methanol is blown off the surface and not allowed to evaporate.)
8.) Anneal at appropriate temperature and time.
Make sure that the thermocouple is in good thermal contact with the sample holder, or you will get completely unreliable annealing temperature readings. Your readings will be fairly unreliable in any case, and susceptible to drift, even with the thermocouple apparently in good contact with the holder. Paranoid people can anneal a series of test chips at different 'temperatures', check all the ohmics, and then anneal their main chip at the optimum on the same day.

Gates recipe

1.) Photolithography as detailed in photolithography recipe
2.) Dip with 3:1 DI:ammonium hydroxide for 5s, rinse with DI water for 15s
3.) Evaporate gate layer. There are three possibilities:
   a.) 25nm Cr + 150nm Au in the Marcuslab thermal evaporator. This is easy and normally reliable
   b.) If you are worried about having antiferromagnetic Cr close to your 2DEG, you can skip the Cr layer. Liftoff is then much less reliable, though, because gold adheres poorly to wafer.
   c.) 25nm Ti + 150nm Au, using the downstairs thermal evaporator.
   Note: Although titanium evaporation is possible using the Marcuslab e-beam evaporator, it has as far as I know never been tried for gates, because of the possible radiation damage to the 2DEG.
4.) Liftoff and clean as with ohmics.

If lift-off is a problem, see also *A reliable lift-off process*, available at
http://marcuslab.harvard.edu/how_to.html

Edward Laird, January 2003, based on *Heather/Alex/Ron/2002 Cleanroom Recipes*