SOP for plasma activated direct bonding with the Flipchip tool

This procedure is intended to be run with two chips whose surfaces have been activated with a plasma treatment and have been dipped in DI water for 30 s and dried with N_2. The plasma activation allows the chips to be bonded together without an adhesive layer. It was developed using a 5x5 mm piece as the die chip, and a 10x12 mm piece as the substrate chip.

1. Enable the Flipchip in Badger
2. Turn on the main module and computer. Open the WinFlipChip software, log in, and open the process file
3. Use the camera to adjust the position of the die pick and heating plate
4. Adjust the force arm to 90 N
5. Place larger chip on heating plate and turn on the heating plate vacuum to secure it in place
6. Calibrate CCH vacuum before attaching chip to die pick
7. Attach smaller chip directly to die pick
    a. This is to prevent the activated chips from coming into contact before bond is initiated
    b. Place small plastic dish under die pick to catch chip in case it is dropped
    c. Curved tweezers are helpful for placing chip directly onto die pick
8. Calibrate CCH vacuum after attaching chip to die pick
9. Bring down force arm to bring chips into contact
10. Start timer for 5 minutes
11. Press Head Vacuum pedal and lift force arm up
12. Disengage heating plate vacuum
13. Remove chips from heating plate and place in a plastic dish
14. Press down firmly on top chip with tweezers. With second pair of tweezers, apply pressure on the rest of the chip
    a. See Nano Nugget on Bonding with Tweezers for further details
15. Pick up chips with tweezers and squeeze together from above and below
16. Disable tool in Badger

Following this procedure, it is recommended to anneal the bonded chips at a temperature suitable for the bonded materials to remove excess moisture and strengthen the bond.