THE nanoFAB UNIVERSITY OF ALBERTA
Fabrication | Characterization | Expertise

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Temporary wafer bonding using Crystalbond

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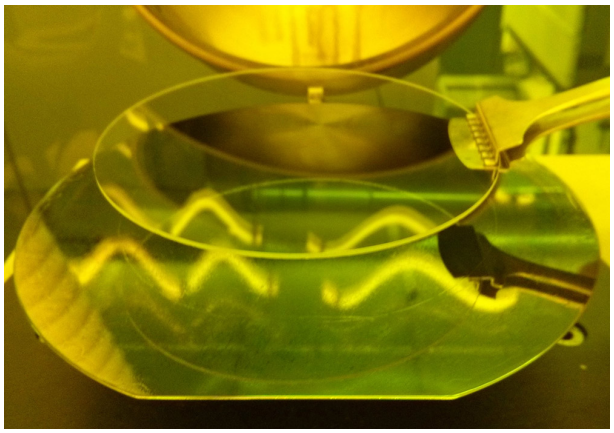

Location: nanoFAB lithography area

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OVERVIEW

The nanoFAB currently provides Crystalbond 555HMP as a temporary bonding adhesive, used primarily for attaching wafers and smaller pieces to 150 mm carrier wafers for processing in our plasma etch systems. Crystalbond is vacuum compatible, provides reasonable thermal conduction, and can be removed with water. This document describes two methods of bonding using Crystalbond: 1) melting Crystalbond directly onto the carrier wafer, and 2) spin-coating the Crystalbond to achieve a thin, uniform coating.

SAFETY PRECAUTIONS

> **N.B.** After processing, ensure that all equipment (hotplate, tweezers, gloves, etc.) are free from melted Crystalbond and/or aqueous Crystalbond solution by rinsing copiously with water and/or wiping with a water-soaked cleanroom wipe. Crystalbond residue is colourless and can therefore easily contaminate specimens or tools during subsequent processing if it goes unnoticed.

Before bringing any new materials into the nanoFAB for processing, it is necessary to fill out a new chemical import form (www.nanofab.ualberta.ca/user-information/user-forms/chemical-import-form/).

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OPERATING PROCEDURE

3.1 Melted Crystalbond

Direct application of Crystalbond by melting it onto a hot carrier wafer is the simplest approach, but practice may be required to achieve a good bond with good repeatability.

1. Using a hotplate, heat the carrier wafer to ~80 °C (the melting point of the 555HMP is 66 °C).
2. Press and spread the Crystalbond stick evenly in an area slightly smaller than the size of the sample to be mounted.
3. Place the sample onto the melted Crystalbond and press it down where possible. Slide and/or rotate the sample to ensure even backside contact and remove any trapped air.
4. Remove the wafer stack and allow to cool; the Crystalbond will take several minutes to harden and recrystallize.
5. Remove any excess Crystalbond not covered by the sample using a cleanroom wipe soaked with water. Minimize the amount of Crystalbond exposed; in particular, ensure that the carrier wafer backside and the clamping area on its outer edge are completely free from Crystalbond. Poor bonding will likely result in poor thermal contact and sample overheating during plasma etching, or potentially a shattered sample due to trapped air in a high-vacuum environment.
6. Ensure that the hotplate surface is free from Crystalbond residue by wiping with a water-soaked cleanroom wipe.

3.2 Spin-coated Crystalbond

To achieve a thinner, more uniform coating, the Crystalbond may be dissolved in water to form a solution. The nanoFAB's standard recipe uses 20 g of crushed Crystalbond dissolved in 100 mL of warm water. Bottles of Crystalbond solution are kept with the other bottles of resist in the main lithography area.

1. Using the Solitec Spinner in lithography, centre the carrier wafer on the spin chuck and dispense ~4 mL of the Crystalbond solution at the centre of the wafer. Using a pipette tip, manually spread the solution all the way to the wafer edge to create an even surface.
2. Allow the film to self-level, then run the following spin recipe:
   - Spin speed: 500 RPM
   - Spin time: 50 s

   Using the above spin parameters will result in a final thickness of ~1.5 µm. Thicknesses may be varied by adjusting the spinning parameters, or by adjusting the ratio of Crystalbond to water when preparing the solution.
3. Set the Solitec Vacuum Hotplate to 95 °C and place two wafer-shaped aluminum blanks on the hotplate surface to allow the 150 mm carrier wafer to sit flat.

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4. Place the Crystalbond-coated wafer on the aluminum stack and allow the water to evaporate for ~1 minute.
5. Carefully place the sample to be mounted at the centre of the carrier and press it down where possible. Let the wafer stack sit untouched for ~2 minutes to allow a bond to form. After 2 minutes, press down again in all areas in an attempt to remove any trapped air or voids. Rotating the mounted wafer may also help to ensure good contact.
6. Set the vacuum timer for 300 s, close the lid, and press **Start** to perform a 5-minute bonding step under vacuum.
7. Remove the bonded wafer stack and allow the stack to cool. Once cool, rinse the carrier wafer with water to remove excess Crystalbond from the outer edge of the wafer. Dry with N_2 and re-bake if required.
8. Allow the wafer to cool completely to ensure full recrystallization of the Crystalbond before processing.

3.3 Removal

One method to remove the mounted wafer from the carrier is to reheat the wafer stack on a hotplate to melt the Crystalbond, then carefully slide the processed wafer off. If the wafer is fragile, however, this is not the recommended method.

A second method is to use hot water to melt and dissolve the Crystalbond. At one of the Aisle 1 wetdecks, fill the electric kettle with DI water and heat it to boiling. Pour the hot water into a labelled glass baking dish and place the wafer stack into the water; using a 150 mm cassette as a wafer carrier is recommended, but not necessary. Wait until the process wafer ”floats” off before removal. A second heated bath may be necessary to speed up the process, or the stack may be left to soak overnight.

A removed process wafer may be cleaned in water (hot or cold), or by using other standard cleaning methods (e.g., piranha). Ensure the wafer is fully cleaned if further processing is required. Residual Crystalbond will reflow if heated and potentially contaminate the system and/or the process. The carrier wafer should also be cleaned for reuse by rinsing in water or performing a piranha clean.

APPROVAL

Qualified Trainer: Scott Munro

Fabrication Group Manager: Aaron Hryciw

Version history
Scott Munro, 2016-06-11
Aaron Hryciw, 2016-06-26