

PMMA water based exfoliation

2D Crystal Consortium – Materials Innovation Platform

1. Preparation

Prepare the ultrasonic bath at heating mode (30 min ahead)

Prepare the hot plate at 120°C

Prepare a cup of DI water in a beaker on the hot plate

(target temperature 60-70 °C, cover with Al foil)

2. Coating

1st *PMMA*

- Place the substrate on top, turn on VACUUM, select program 5 (1000 rpm for 30 s) and START without PMMA to test the recipe.
 - *Make sure that the sample is in the center
- Apply a few droplet of PMMA on the surface of the sample, close the lid of spin-coater, and START program 5
- Place the sample on a hot plate @ 120 °C for 2 min, cool @ RT for 30 s



Select the program

START



2. Coating

2nd PMMA

- Place the substrate on top, turn on VACUUM, select program 6 (3000 rpm for 30 s) and START without PMMA to test the recipe.
 - *Make sure that the sample is in the center
- Apply a few droplet of PMMA on the surface of the sample, close the lid of spin-coater, and START program 6
- Place the sample on a hot plate @ 120 °C for 2 min, cool @ RT for 30 s

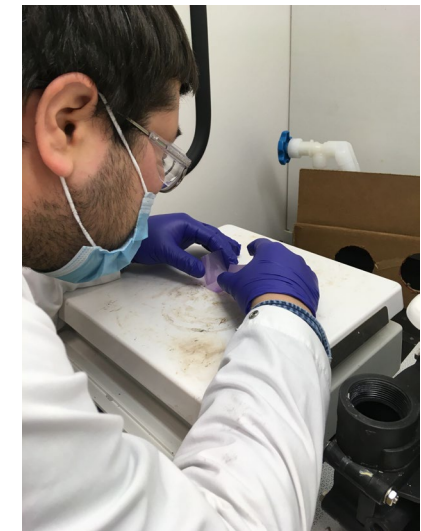
Extra step for WSe₂ samples

- Scratch the four sides of the sample and make sure the sides of the sample are clean

3. Exfoliation

Attach thermoresist

- Prepare DI water @ 80 °C
- Place the sample on a hot plate @ 70-80 °C for about 1 min
- On the hot plate, attach the thermoresist film (with the thinner film detached) on top of the sample, from the center to the edge while holding the both right and left edges of the thermoresist film by hands → tweezers
- Make sure that the film is fully attached using a cotton rod (with no bubble)

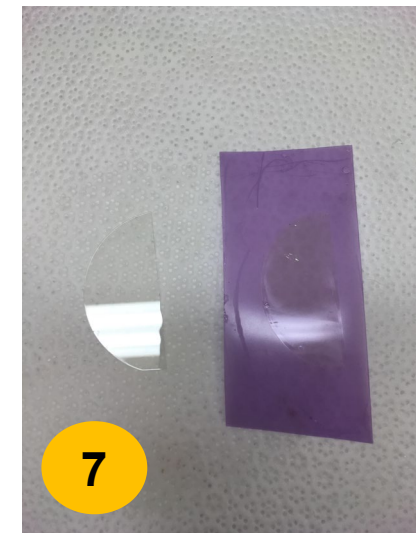
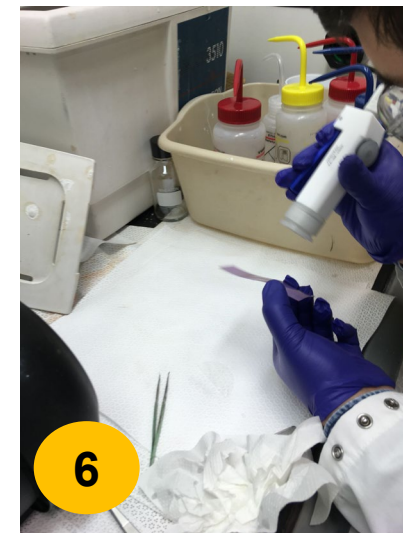
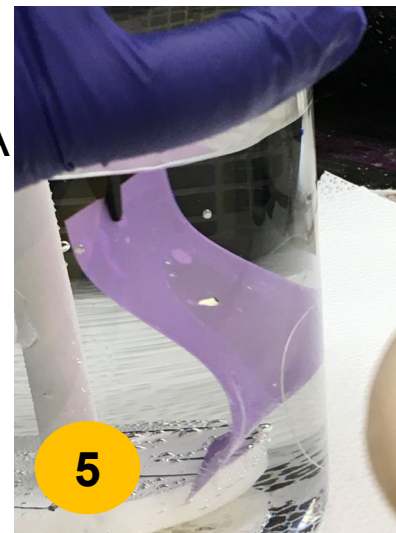
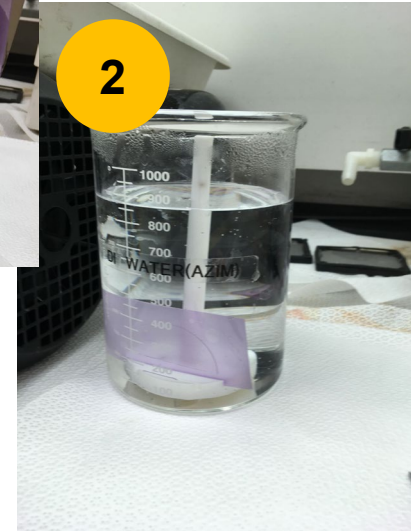
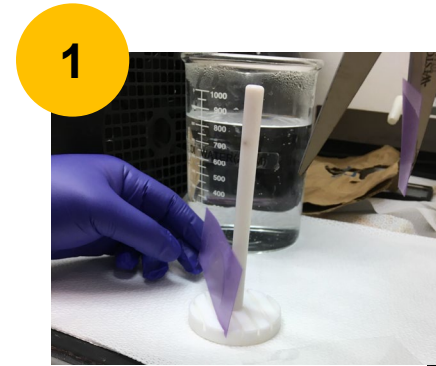


Thermoresist tape

3. Exfoliation

Ultrasonic bath

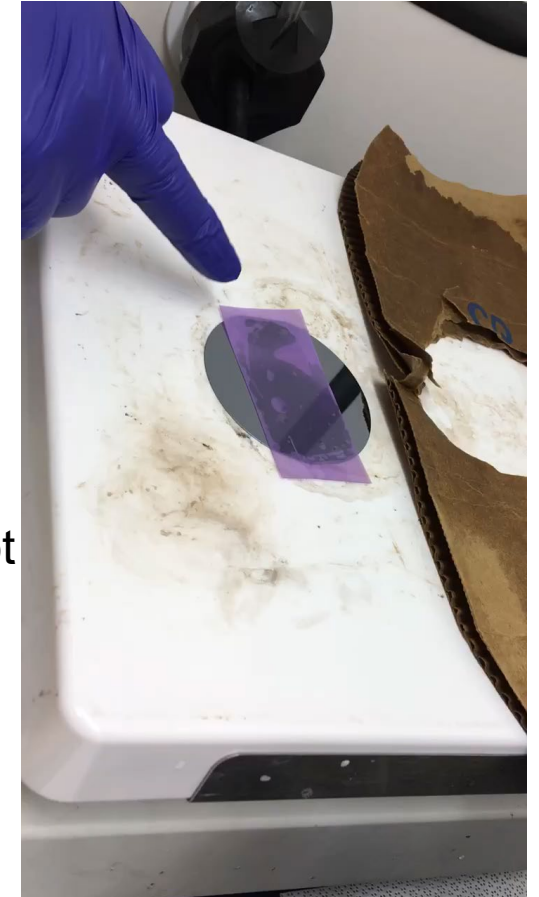
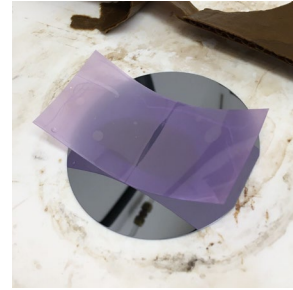
- Put the sample with the thermoresist film in the wafer holder and put in inside the DI water @ 80 °C
- Keep in the ultrasonic bath for 12 min
- After 12 min, Peel off the thermoresist film from the substrate gently with a tweezer inside the DI water in the beaker
- The thermoresist film now has MoS₂/PMMA



3. Exfoliation

Transfer

- Prepare a target wafer (Si) on a hot plate @ 120 °C
- Attach the film (on the thermoresist) to the target substrate on the hot plate @ 120 °C (same as the way of attaching the thermoresist tape)
- Keep the sample @ RT and increase the hot plate temperature to 180 °C
- When the hot plate temperature reached 180°C, place the wafer on the hot plate and observe thermoresist tape being removed.



4. Dissolve PMMA

- Put a wafer with MoS₂/PMMA in acetone for 1 day.
- Dry the wafer with nitrogen.
- Soak in IPA, put in ultrasonic bath for 10 min
- Dry the wafer with nitrogen.

