1. PRF# 59267-DNI10
2. Project Title - Tailoring Sub-Nanometer Pores in Atomically Thin Membranes for Petrochemical Separations
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ACS PRF funding has enabled the exploration of atomically thin 2D materials such as graphene and hexagonal boron nitride (h-BN) for membrane applications. Such atomically thin membranes offer fundamentally new approaches to control nanoscale mass transport and hold promise to revolutionize separation processes. The ACS PRF grant has helped us generate invaluable preliminary data and take the lead in advancing these new research directions and has provided valuable scientific training to a post-doctoral researcher in our group.

Results from the past 13 months are summarized in Figures 1 and 2 below showing successful synthesis of atomically thin 2D materials in our laboratory. In the next 11 months we will make membranes from the synthesized 2D films.

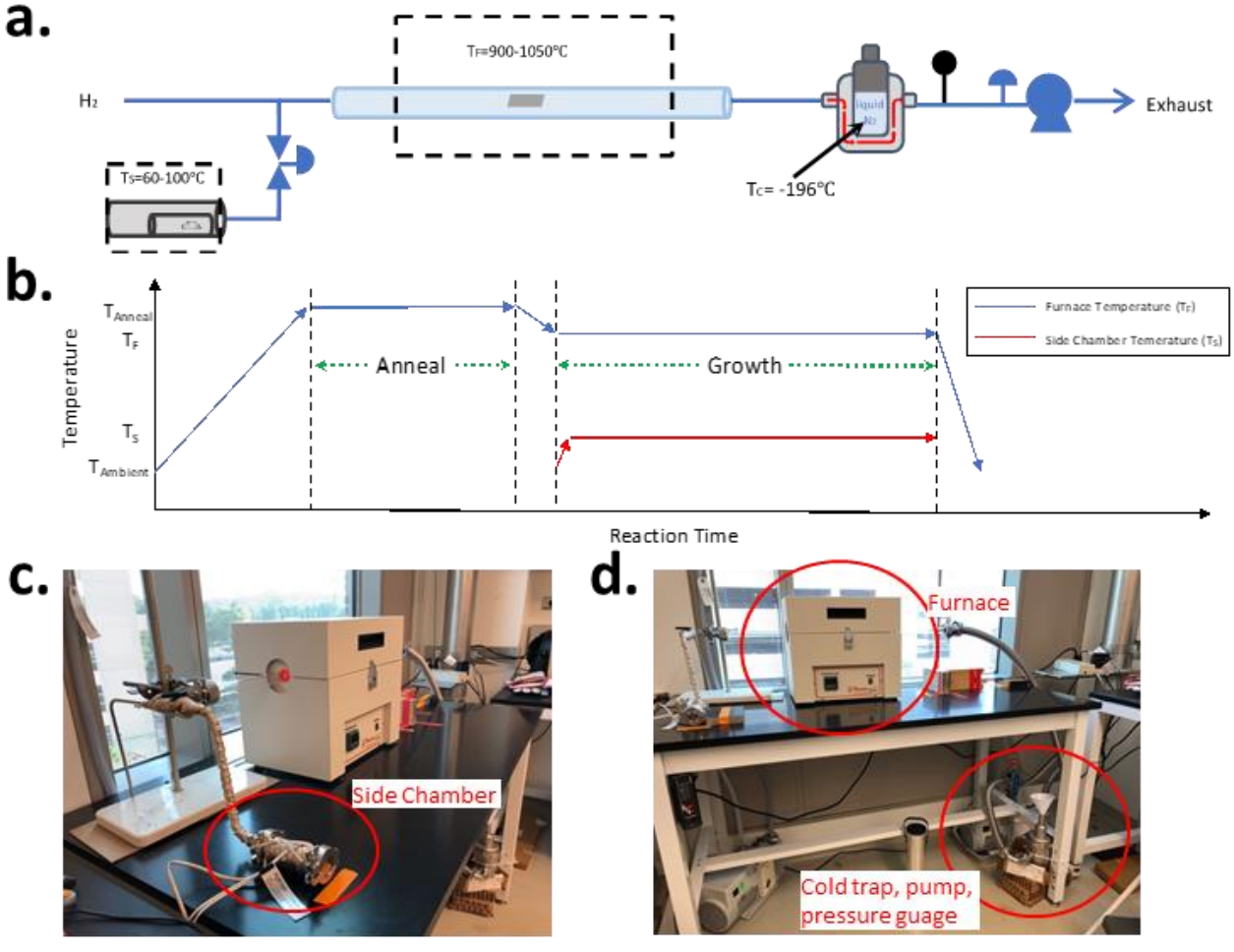

Figure 1. a. Schematic of our chemical vapor deposition (CVD) reactor. **b.** Diagram of typical growth run featuring temperature profiles of both the furnace temperature and the side chamber temperature where ammonia borane precursor is sublimed. **c.** Side-view of as-built CVD system at growth temperature. Heat-tape wrapped side chamber and glowing ceramic of the furnace can be seen. **d.** Front facing view of CVD system. A liquid nitrogen cold trap is used to prevent contamination of the pump and also to prevent any pump oil from entering the CVD reactor.

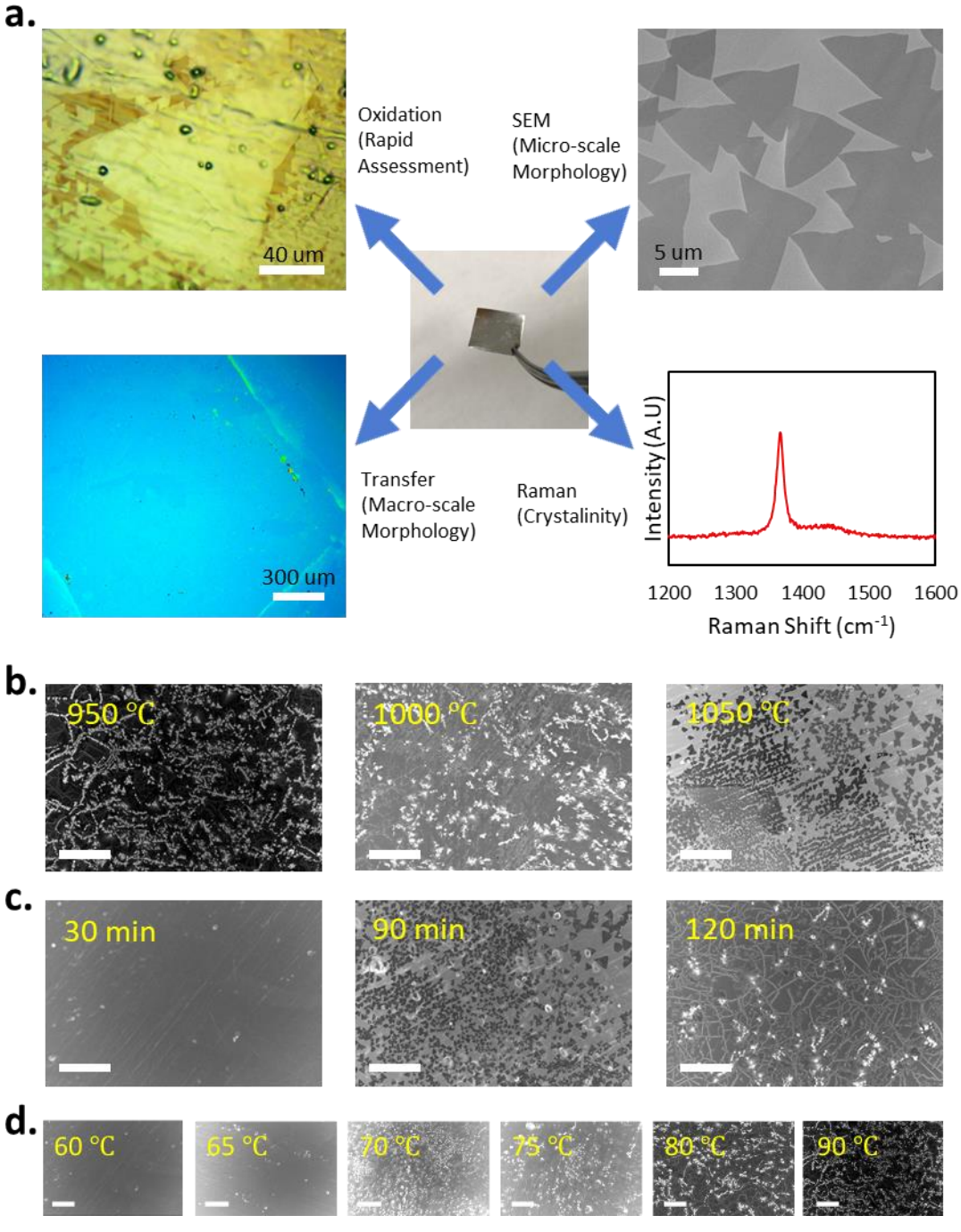

Figure 2. a. Photograph of iron foil after growth (**center**). Optical image of as-grown foil after 30 min of oxidation at 250℃. Layer dependent contrast is observed due to increasing oxidation protection of iron foil by multiple *h*-BN layers (**top left**). SEM image of individual monolayer *h*-BN domains (**top right**). Optical image of incomplete film transferred from iron foil onto 300 nm SiO_2 / Si wafer substrates (**bottom left**). Raman spectrum acquired for *h*-BN transferred onto 300 nm SiO_2 / Si wafer substrates (**bottom right**). **b.** SEM images of *h*-BN films grown for 30 minutes (T_s=90℃) at varying furnace temperatures. **c.** SEM images of *h*-BN films grown for increasing amounts of time (T_s=60℃, T_F=950℃). **d.** SEM images of *h*-BN films grown for 30 min (T_F=950℃) with varying side chamber temperatures. Scale is 100μm for **b.-d.**