Materials Research Science and Engineering Center
DMR-1719797
2020

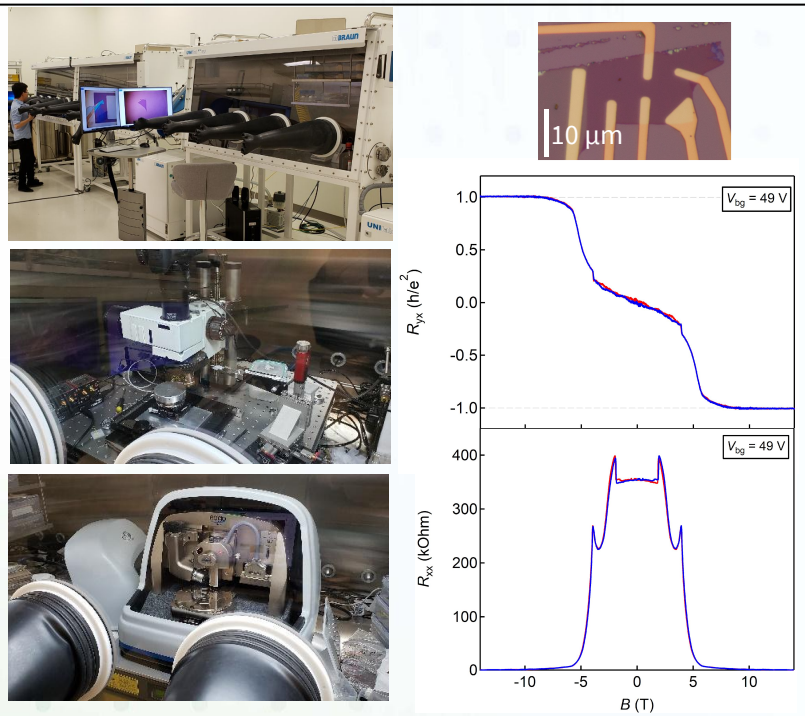
Unique facilities: foundry for air-sensitive 2D materials

MEM-C Shared Facilities
NanoES Building, University of Washington, Seattle

A centerpiece of the MEM-C Shared Facilities is a custom-built, integrated system tailored for creating, probing and stacking air-sensitive 2D materials.

The entire 2D production line, turning crystals into encapsulated stacked heterostructures, is fully contained in this connected chain of Ar-filled glove boxes (<0.1 ppm O_2 and H_2O). There are two optical microscopes, a computerized multi-axis transfer stage, a Bruker Edge AFM, a wafer spinner, storage, and feedthroughs to a crystal growth furnace. An adjacent Icon AFM provides nanomanipulation, lithography and piezo force imaging.

As an example, this unique foundry has enabled dramatic progress in the last year with exotic but extraordinarily air-sensitive materials such as the Chern/axion insulator candidate $MnBi_2Te_4$ (see figure).



A chain of glove boxes (top) contains a computerized transfer setup (middle), AFM (bottom), and other 2D processing components. Right: (top) device made in this foundry: a 6-layer flake of the highly air-sensitive magnetic topological insulator $MnBi_2Te_4$ which (beneath) shows the quantum anomalous Hall effect in electrical transport at 2 K.