



# Fabrication and Characterization of Carbon Nanotube Field-Effect Transistors



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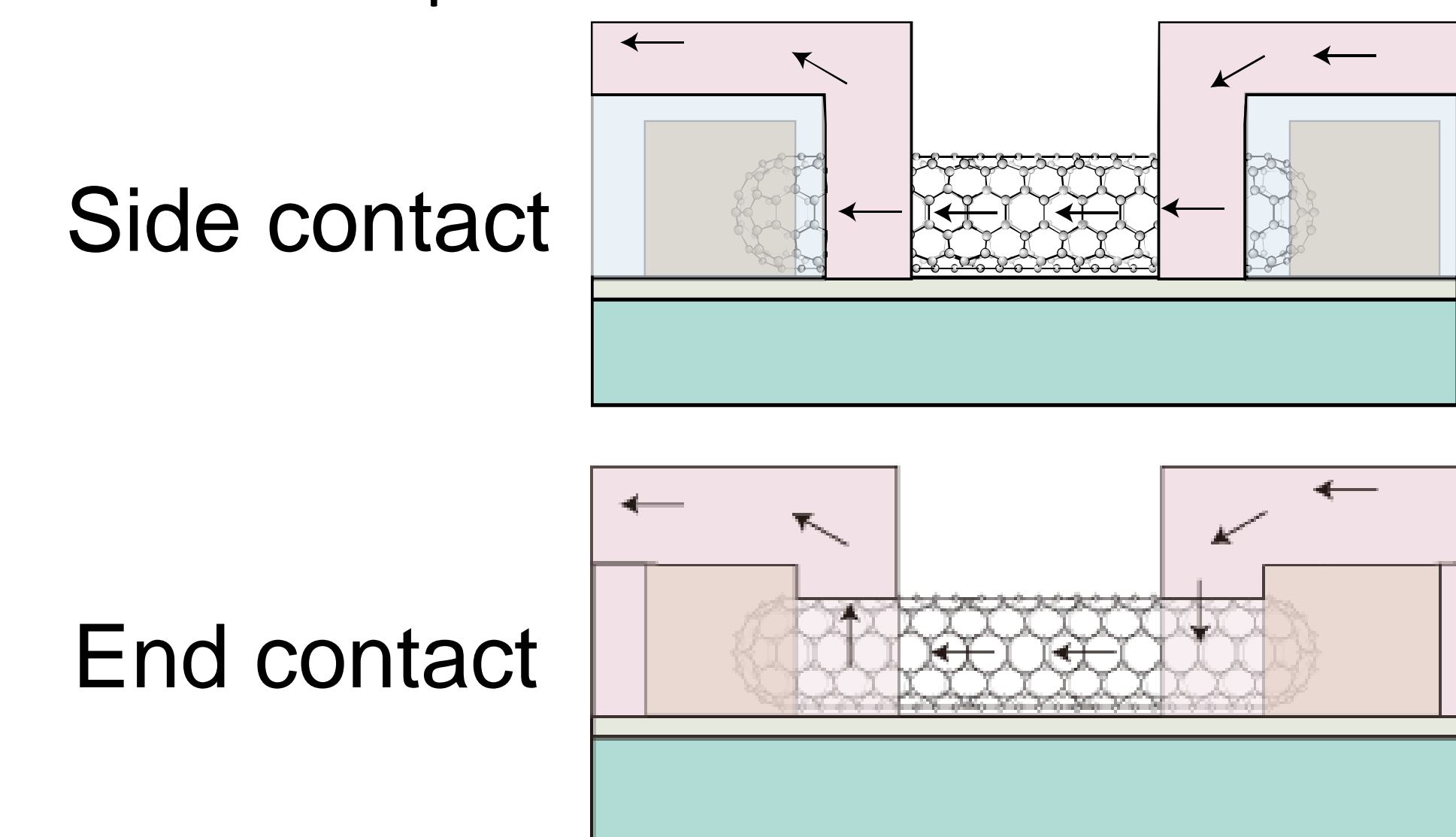
## Background

### Carbon Nanotubes (CNT)

- Semiconducting or metallic
- Weak spin-orbit coupling

### CNT Field-Effect Transistors (CNTFETs)

- Possible spintronic applications
- Cannot control junction resistance due to varying CNT properties
- End contact geometry – efficient charge carrier transport?



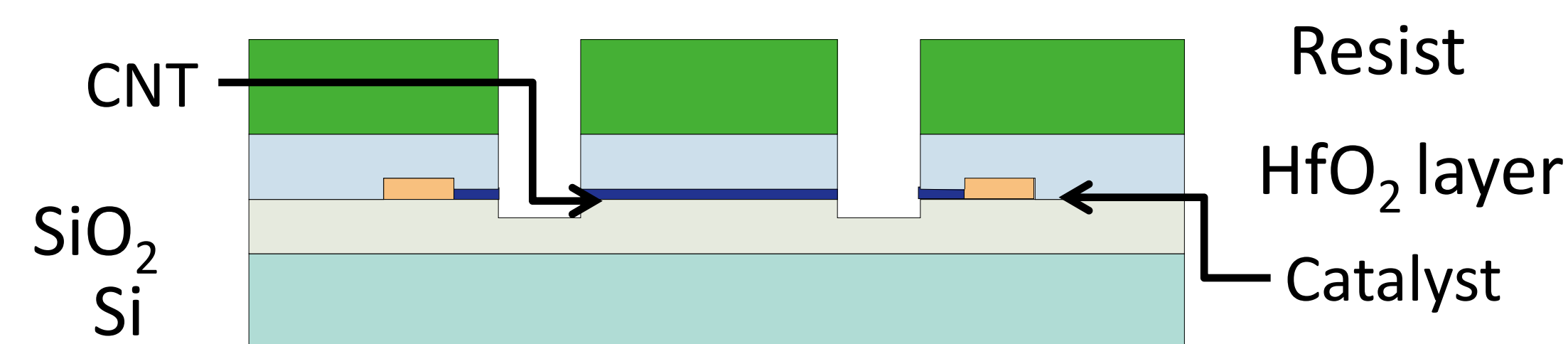
## Purpose

- Realization of end contact junction between metal and CNT
- Fabrication of CNTFET with end contact junction
- Fabrication of CNT spin devices with end contact junctions

## Methods

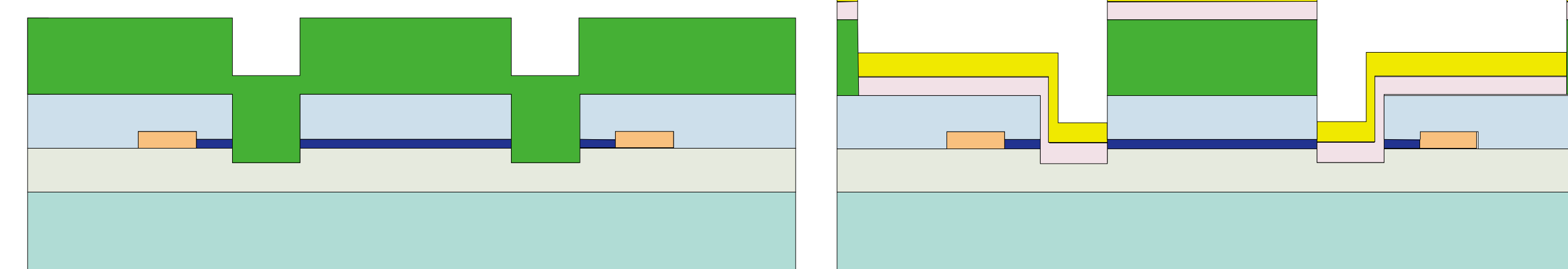
- Start with standard photolithography and chemical vapor deposition for CNT, with a HfO<sub>2</sub> top layer
- Changes for end-contact FET fabrication

### Dry etching

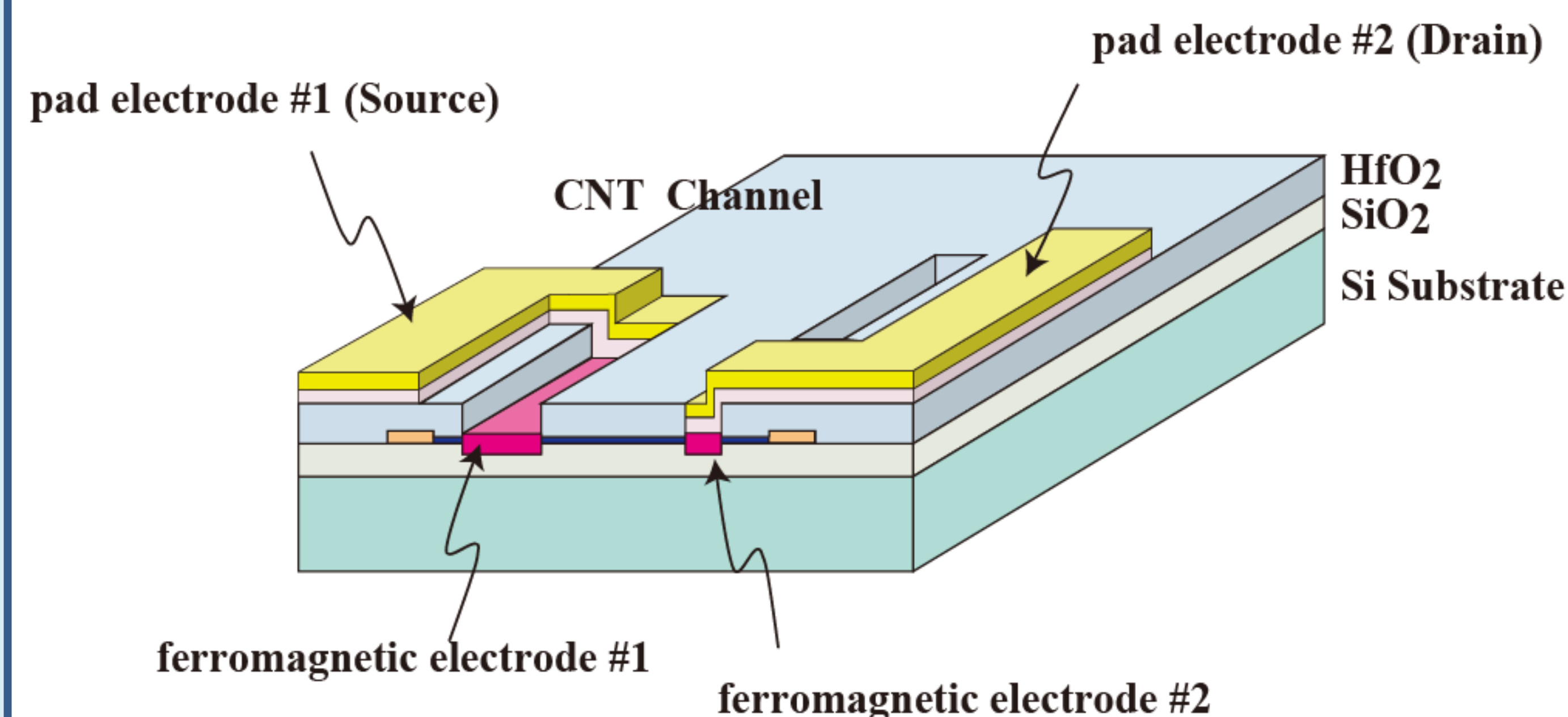


### Lift off and recoat

### Electrode deposition



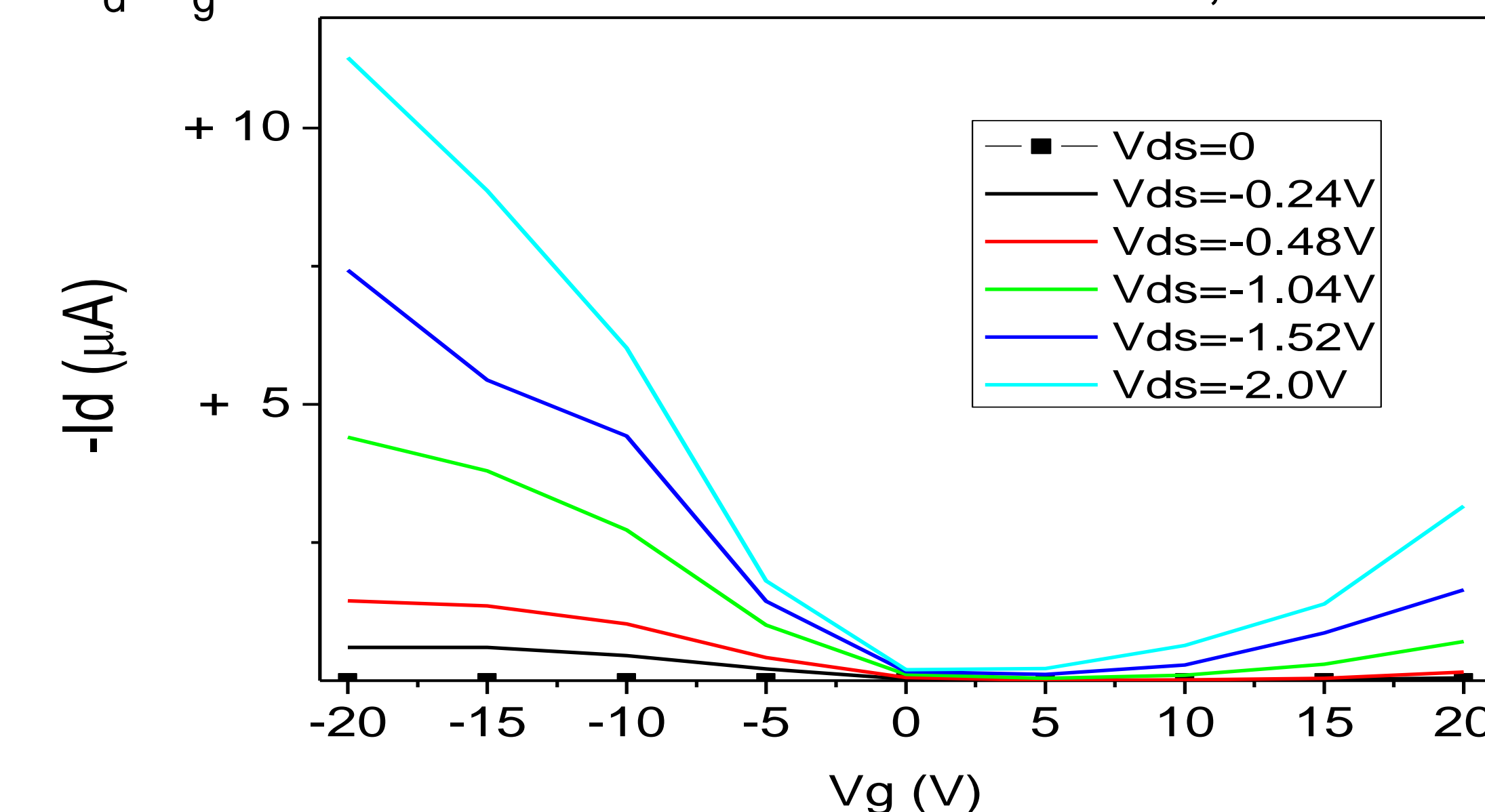
### Completed CNTFET spin device



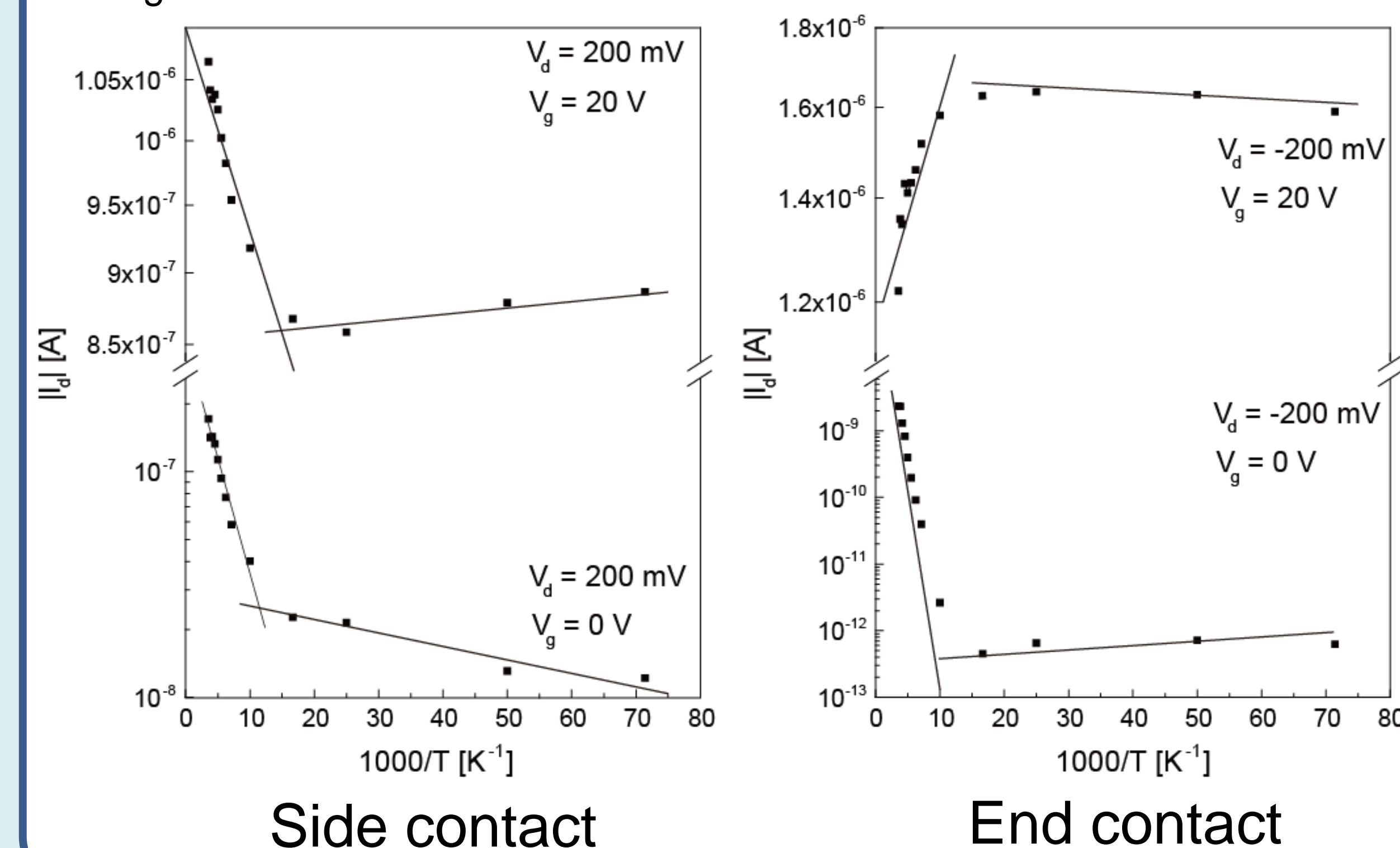
- Measure current-voltage response at different temperatures

## Results

$I_d$ - $V_g$  of a CNTFET with a Pd electrode, T=290K



$I_d$ - $V_g$  Characteristics of CNTFETs with Ti electrodes



## Conclusions and Future Work

- Can fabricate CNT devices with end contacts
- Palladium shows controllable current response
- End contact does not form Schottky barrier easily
- Characterize CNT spin device transport
- Evaluate effect of material on spin transport