Nanopatterning of oxide interfaces using cold ion milling

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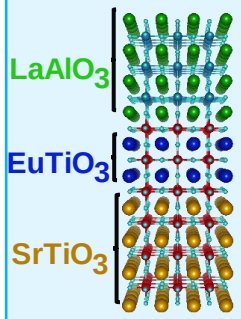
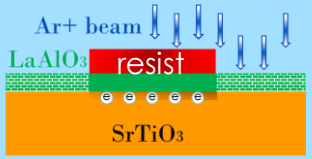


A tunable spin polarized 2DEG is formed in LAO/ETO/STO hetero-structures [1]

1

NANOPATTERNING OF DEVICES

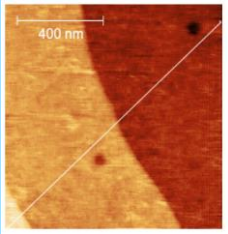
Direct patterning using e-beam lithography and Ar+ ion milling at low temperature

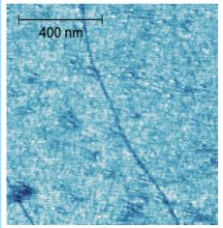


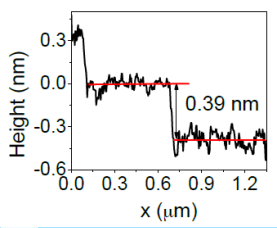
- resolution >160nm
- etching rate: 2 nm/min;

2

AFM and LATERAL FORCE MICROSCOPY OF STO SUBSTRATE



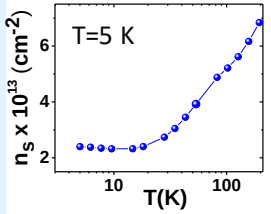


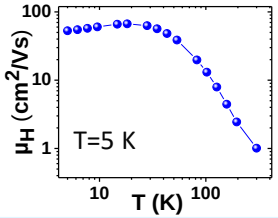


small areas of the etched (STO) substrate show two terraces with step height of one unit cell.

3

TRANSPORT PROPERTIES





$n_{2D}=2.3\times10^{13}$ cm^{-2} is in agreement with literature data for pristine LAO/STO and LAO/ETO/STO samples

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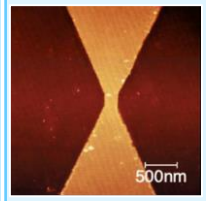
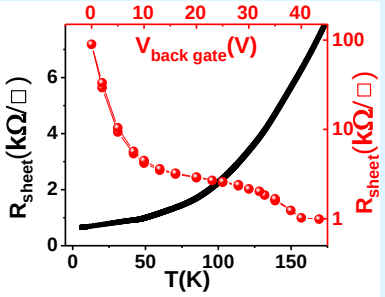
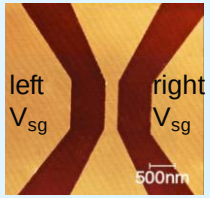
NANODEVICES ELECTRICAL TRANSPORT [2]

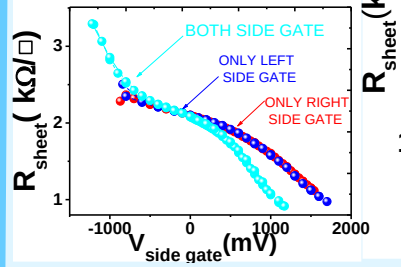


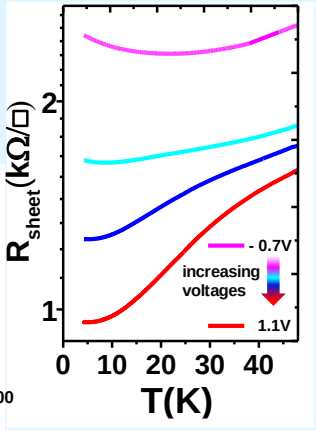
DAYEM BRIDGE

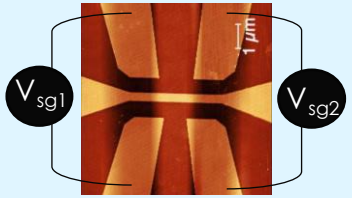




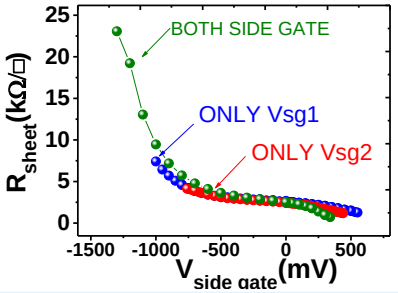
ONE SIDE GATE

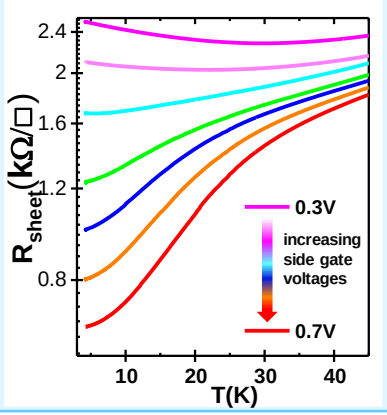


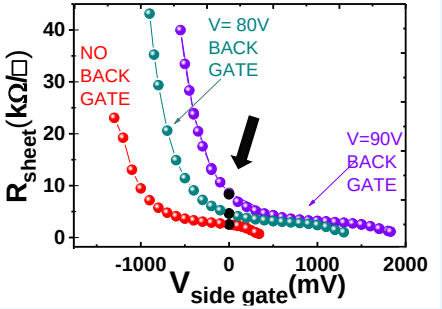




TWO SIDE GATE







zero point modulation

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REFERENCES
[1] D. Stornaiuolo et al., Nature Mater., 15, 278–283 (2016)
[2] D. Stornaiuolo et al. Physical Review B90, 235426 (2014)
[3] N. Pryds et al. Adv. Mater. Interfaces, 6, 1900772 (2019)

CONCLUSIONS: Our technique can be adopted for
- nanopatterning all types of oxide heterostructures,
- the realization of hybrid structures where the 2DEG is laterally coupled to other materials[3].