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Supporting Online Material for

Oxide Interfaces—An Opportunity for Electronics

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Fig. S1

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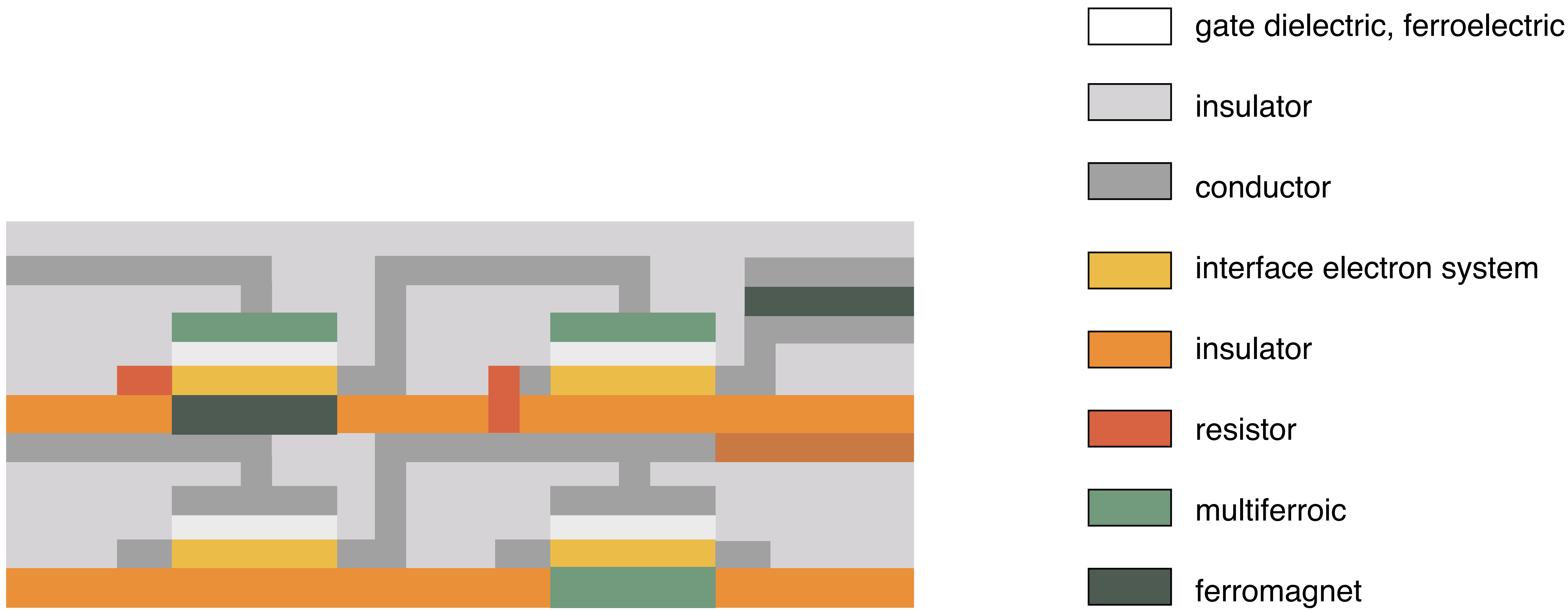

Mannhart, Schlom, Figure S1

Figure S1:

Sketch illustrating possible multilayer devices using interfaces in complex oxides. The illustration shows a cross-sectional cut through a hypothetical device.

Table S1:

	GaAs - $Al_xGa_{1-x}As$	$LaAlO_3$ - $SrTiO_3$
Carrier density n (without gate field)	several 10^{10} - several 10^{11}/cm^2	several 10^{13} /cm^2
Sheet resistance ρ (H=0)	order of 10-100 Ω/□ (low T, samples with high-μ)	~ 200 Ω/□ (4.2 K) ~ 20 kΩ/□ (300 K)
Thickness d	order of 10 nm	~ 10 nm (4.2 K) ≲ 4 nm, possibly 0.4 nm (300 K)
Equivalent volume carrier concentration	order of 10^{17} /cm^3	order of 10^{20} /cm^3
Typical thicknesses of the host layers in heterojunctions (*e.g.*, cap layers)	tens of nanometer	≥ 1.6 nm $LaAlO_3$ (4 unit cells)
Hall mobility μ	≳ 10^7 cm^2/Vs (4.2 K)	≲ 1000 cm^2/Vs (4.2 K) ≲ 10 cm^2/Vs (300 K)
Effective mass m of carriers at interface	m_e ~ 0.07 m_o	m_e ~ 3 m_o
Mean scattering time τ, mean free path	100 psec, order of 100 µm	psec, tens of nm (4.2 K)
v_F	~ 3×10^7 cm/s	several 10^6 cm/s
Magnetic flux density inducing quantum Hall filling factor ν =1	order of 10 T	order of 1000 T
Energy dependence of density of states $N(E)$	step function of 2-DEG (ideal case)	complex function reflecting the $N(E)$-dependence of the Ti-, La-, and O-ions

	GaAs - $Al_xGa_{1-x}As$	$LaAlO_3$ - $SrTiO_3$
Remarks	• two-dimensional electron gas (2-DEG); • quantum well induced by band bending; • 2D-subbands of nominally free electrons	• two-dimensional electronic liquid (2-DEL); • metal-insulator transition at a few 10^{12} /cm^2; quantum well structure as shown in Fig. 4; • 2D-subbands composed of ionic orbital states with local character (*e.g.,* Ti 3*d*, La 5*d*, O 2*p*); • 2D-superconducting ground state; • strong spin-orbit coupling.

Table S1:

Characteristic values of selected, fundamental parameters of $LaAlO_3$-$SrTiO_3$ (TiO_2-terminated) interfaces compared to the ones of GaAs-$Al_xGa_{1-x}As$ interfaces. The table presents typical numbers of samples with good properties as published by January 2010. For data on the GaAs-$Al_xGa_{1-x}As$ interfaces see, *e.g.*, (*S1-S7*). With respect to the data of the $LaAlO_3$-$SrTiO_3$ interfaces see, *e.g.*, for mobility and carrier concentration (*S8-S15*), superconducting transition (*S12, S16*), thickness of the electron system (*S15-S20*), spin-orbit coupling (*S21*), effective mass (*S22, S23*), spectral density of states (*S23*), with overviews given in (*S24-S26*). The estimation of v_F is based on the model of free electrons using $n_{2D}=k_F^2/2\pi$, the estimations of the scattering time and mean free path are based on the Drude model.

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