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Tuning the ferromagnetism in $LaAlO_3/SrTiO_3$ BEENA KALISKY, Stanford University, USA; Bar-Ilan University, Israel, JULIE A. BERT, BRANNON B. KLOPFER, CHRISTOPHER BELL, Stanford University, USA, HIROKI SATO, Stanford University, USA; University of Tokyo, Japan, YASUYUKI HIKITA, HAROLD Y. HWANG, KATHRYN A. MOLER, Stanford University, USA — The interface of $LaAlO_3/SrTiO_3$ heterostructures exhibits both conductivity and magnetism. Significant effort has been invested researching the details and characteristics of the conductivity, such as conductance only above a critical $LaAlO_3$ thickness. However, reports of ferromagnetism differ in a variety of details requiring further investigation into the material properties that control magnetism. In this study we use a scanning SQUID microscope to locally image the landscape of ferromagnetism as a function of several tuning parameters including the $LaAlO_3$ thickness, back gate voltage, local strain and surface treatment. We find that the ferromagnetism is inhomogeneous within each sample, varies considerably between samples, and appears only in samples whose $LaAlO_3$ layer is thicker than a threshold value, similar to the conductance critical thickness. The ferromagnetism changes with local strain, surface treatment with polar solvents and applied field. However it is not affected by changing the gate voltage or cycling the temperature up to 300K. These results provide experimental input for determining and controlling the mechanisms of magnetism in engineered complex oxide interfaces.

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