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Microscopic order parameters coupling at domain walls and its effect on macroscopic properties. SAEEDEH FAROKHIPOOR, Department of Materials Science, University of Cambridge, UK, UMUT ADEM, Department of Materials Science, Izmir Institute of Technology, Turkey, ULI ZEITLER, Radboud University, Nijmegen, NL, AGUNG NUGROHO, Faculty of Mathematics and Natural Sciences, Bandung, Indonesia, JOHAN BUURMA, GRAEME BLAKE, BEATRIZ NOHEDA, THOMAS PALSTRA, Zernike Institute for Advanced Materials, University of Groningen, NL — Domain and domain wall (DW) engineering provides an alternative model to tune the physical properties of materials, typically done via conventional materials chemistry. The interplay of coexisting non-ferroelectric structural order parameters, ferroelectric and magnetic order parameters at the DWs in hexagonal manganites provides a new pathway to determine macroscopic properties by tuning the DW characteristics [1]. Here, we report different types of domain structures and DW types associated with the crystal growth conditions in hexagonal manganites. We show that differences in the DW polar state manifest themselves as variations in the conductivity measured macroscopically. Piezo force microscopy and X-ray diffraction enables us to determine the plane of the DWs and hence, their strain state. The latter findings corroborate with the topographical study. Finally, these results show that DWs under strain lower the critical field of the magnetic phase transition compared to samples with strain-free DWs. This work represents the first example of non-local physical properties being determined by the presence of topographically protected DWs. [1] S. Artyukhin et al., Nat Mater **13** (2014)

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