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Surface spin characterization of Cr₂O₃ films epitaxially grown on (001) TiO₂ and (0001) Al₂O₃¹ WEI YUAN, TANG SU, QI SONG, TIANYU WANG, International Center for Quantum Materials, Peking University, ZHANGYUAN ZHANG, PENG GAO, Electron Microscopy Laboratory, School of Physics, Peking University, JING SHI, Department of Physics and Astronomy, University of California, Riverside, WEI HAN, International Center for Quantum Materials, Peking University — Cr₂O₃ is an interesting antiferromagnetic material, which has been widely investigated because of its high Neel temperature and the electric field control of its exchange bias at room temperature. We have epitaxially grown the Cr₂O₃ films on (001) TiO₂ and (0001) Al₂O₃. For the growth on TiO₂, we find that the Cr₂O₃ film is (10-10) oriented, confirmed by XRD and high resolution TEM. As the spins of the Cr atoms are parallel to the *c* axis, the surface spins of the (10-10) Cr₂O₃ film are manipulated to align in-plane, as indicated from the exchange bias measurement of the Py/(10-10) Cr₂O₃ interface. Furthermore, we observe a positive exchange bias that depends on the direction of the cooling and measuring magnetic fields. On the other hand, (0001) Cr₂O₃ film is epitaxially grown on (0001) Al₂O₃ substrate. And the crystal structure is confirmed by XRD. For this (0001) film, the exchange bias is found to be perpendicular to the plane, indicating that the spins of the (0001) Cr₂O₃ film are out-of-plane. Our results demonstrate crystal structure manipulations of the exchange bias and the collinear exchange coupling between the surface spins of the Cr atoms and the adjacent FM layer.

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