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Soft X-ray absorption spectroscopy and magnetic circular dichroism study of valence and spin states of half-metallic CrO_2 nanorods SEUNGHO SEONG, J.-S. KANG, D.H. KIM, EUNSOOK LEE, HYUN WOO KIM, Department of Physics, The Catholic University of Korea, SOONCHIL LEE, Department of Physics, KAIST, JOONGHOE DHO, Department of Physics, Kyungpook National University — Half-metallic ferromagnetic CrO_2, with the Curie temperature $T_C \sim 390\ K$, is very interesting because most of the transition metal oxides are antiferromagnetic insulators. It has been proposed [1] that the metallic ferromagnetism in CrO_2 originates from the oxygen-mediated double exchange interaction between mixed-valent Cr ions, caused by self-doping. But this issue is controversial.[2] We have investigated the valence and spin states in CrO_2 nanorods by employing soft X-ray absorption spectroscopy (XAS) and soft X-ray magnetic circular dichroism (XMCD). The valence states of Cr ions are found to be Cr^{3+}-Cr^{4+} mixed-valent at the surfaces, but nearly Cr^{4+} in the bulk. The temperature-dependent XMCD intensity is observed, in agreement with the bulk T_C. We will discuss the electronic structure and its half-metallic ferromagnetism in CrO_2.

[1]M. A. Korontin et al., Phys. Rev. Lett. **80**, 4305 (1998).
[2]J. H. Shim et al., Phys. Rev. Lett. **99**, 057209 (2007).

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