Synchrotron radiation spectroscopy study of $FeCr_2X_4$ (X=S and Se)

J.-S. Kang,[1,2,a)] G. Kim,[1] H. J. Lee,[1] H. S. Kim,[1] D. H. Kim,[1] S. W. Han,[2] S. J. Kim,[3] C. S. Kim,[3] Hangil Lee,[4] J.-Y. Kim,[4] and B. I. Min[5]
[1]*Department of Physics, The Catholic University of Korea, Bucheon 420-743, Republic of Korea*
[2]*CSCMR, Seoul National University, Seoul 151-742, Republic of Korea*
[3]*Department of Physics, Kookmin University, Seoul 136-702, Republic of Korea*
[4]*Pohang Accelerator Laboratory (PAL), POSTECH, Pohang 790-784, Republic of Korea*
[5]*Department of Physics, POSTECH, Pohang 790-784, Republic of Korea*

(Presented on 8 November 2007; received 9 September 2007; accepted 28 December 2007; published online 25 March 2008)

Electronic structures of $FeCr_2X_4$ (X=S and Se) have been investigated by employing soft-x-ray absorption spectroscopy and soft-x-ray magnetic circular dichroism (XMCD). It is found that $FeCr_2S_4$ and $FeCr_2Se_4$ have similar electronic structures. The valence states of Cr and Fe ions are nearly trivalent (Cr^{3+}) and divalent (Fe^{2+}), respectively. The Fe 3d states are strongly hybridized to the X p states. The Fe and Cr 2p XMCD study provides evidence for the antiparallel alignment between Cr and Fe spins and the strong hybridization between the Fe 3d and X p electrons.
 [DOI: 10.1063/1.2839617]