

# Valence-band photoemission spectroscopy of the giant magnetoresistive spinel compound $\text{Fe}_{0.5}\text{Cu}_{0.5}\text{Cr}_2\text{S}_4$

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Electronic structures of the giant magnetoresistive  $\text{Fe}_{0.5}\text{Cu}_{0.5}\text{Cr}_2\text{S}_4$  (FCCS) spinel compound have been investigated using photoemission spectroscopy (PES). Resonant PES measurements around the Cu, Fe, Cr  $3p \rightarrow 3d$  absorption edges exhibit negligible resonant interference behavior for the Cu  $3d$  valence electrons, indicating the monovalent valence state of the Cu ion in FCCS. The top of the valence band is found to be predominantly of the Cr  $3d$  and the nearly filled Cu  $3d$  electron character, whereas the Fe  $3d$  electron character is distributed over the whole valence band. The measured valence-band PES spectra of FCCS yield better agreement with the LSDA+ $U$  calculation than with the local spin-density approximation (LSDA) calculation, suggesting the importance of the large Coulomb interactions  $U$  between  $d$  electrons. On the other hand, the low spectral intensity near  $E_F$  in the measured valence-band spectrum suggests an extra localization in FCCS, not explained by the large  $U$  alone.