High-resolution photoemission study of quasi one-dimensional half-metal NaV_2O_4

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Very recently, synthesis of a new vanadium oxide NaV_2O_4 was reported [1]. This compound exhibits a quasi one-dimensional (1D) metallic nature below the antiferromagnetic (AF) transition temperature T_N. Moreover, the band calculation suggests a half-metal-like band structure in the low temperature AF state. Hence it is interesting to study the electronic structure of the quasi-1D half-metal compound NaV_2O_4.

We have carried out high-resolution photoemission spectroscopy (PES) on NaV_2O_4. The valance band PES spectrum consists of well-separated two main bands; one originates in the V 3*d* states located around the Fermi level (E_F) and the other is due to the O 2*p* states situated far away from E_F in qualitatively good agreement with the band calculation. For all measured temperatures from 5 to 300 K, the spectral intensity near E_F is strongly suppressed and shows a power-law behavior, implying the Tomonaga-Luttinger-liquid lineshape characteristic of quasi-1D materials. The anomalous exponent α shows a considerable temperature dependence, in particular around T_N. The temperature dependence of α is also consistent with the variation of the transport anisotropy with temperature. There results suggest a close relationship between the electronic structure near E_F and the magnetic order and/or the dimensional crossover.

[1] K. Yamaura *et al.*, Phys. Rev. Lett. 99, 196601 (2007).