[III~18]

Photoemssion Study of VF_3, CrF_2, and $CrCl_2$

Youngho Choe, H.J. Kim, S.-H. Yang, and S.-J. Oh
Department of Physics, Seoul National University, Korea

E.-J. Cho
Department of Physics, Chonnam National University, Korea

S.-M. Chung
Department of Physics and Basic Science Research Center, Pohang University of Science and Technology, Korea

We have performed resonant photoemission studies for VF_3, CrF_2, and $CrCl_2$, which are all light 3*d* transition metal (TM) insulating compounds, in order to investigate their electronic structures, especially the valence bands. For late 3*d* transition metal compounds, it is well known that the charge transfer from the ligand to the metal is important, and the character of the energy gap is the charge-transfer (CT) type in the Zaanen-Sawatzky-Allen scheme. But, for light 3*d* TM compounds, such as V and Cr halides, it is not yet clear whether the CT model can be successfully applied to these systems or not.

Photoelectron measurements were carried out at BL-2 of SOR-RING. We prepared clean samples for photoemission measurement by evaporating pure compounds on the clean holder for VF_3, CrF_2, and $CrCl_2$. We did not find any surface contaminations after these surface preparations.

In Fig.1, we show the energy distribution curves (EDC's) measured at various excitation photon energies $h\nu$ across the TM 3*p* edge. The excitation photon energy is indicated on the right-hand side of each EDC. In VF_3 (Fig.1 (A)), we see the flourine 2*p* band around the binding-energy of 10 eV. And, as the photon energy is increased across the TM 3*p* edge, the peak in the binding-energy range between 0 and 5 eV is enhanced. From this we can infer that they have the character of metal 3*d* band. In CrF_2 (Fig.1 (B)), the two-peak structure is similar to that of VF_3. So the character of each peak should be similar. In $CrCl_2$ (Fig.1 (C)), we see the two-peak structure again, but the chlorine 3*p* band has a different shape from the flourine 2*p* band in Fig.1 (A) and (B).

In summary we have performed the resonant photoemission in TM 3*p* edge, and definitely characterized the peak of the lowest binding-energy as a metal 3*d* origin. But there seems to be strong hybridization between TM 3*d* states and ligand *p* states. The enhancement of spectra is observed across the TM 3*p* edge as expected in our photoelectric yield spectra (Fig.1 (D)), and the resonance photon energy is found to be very broad as shown.

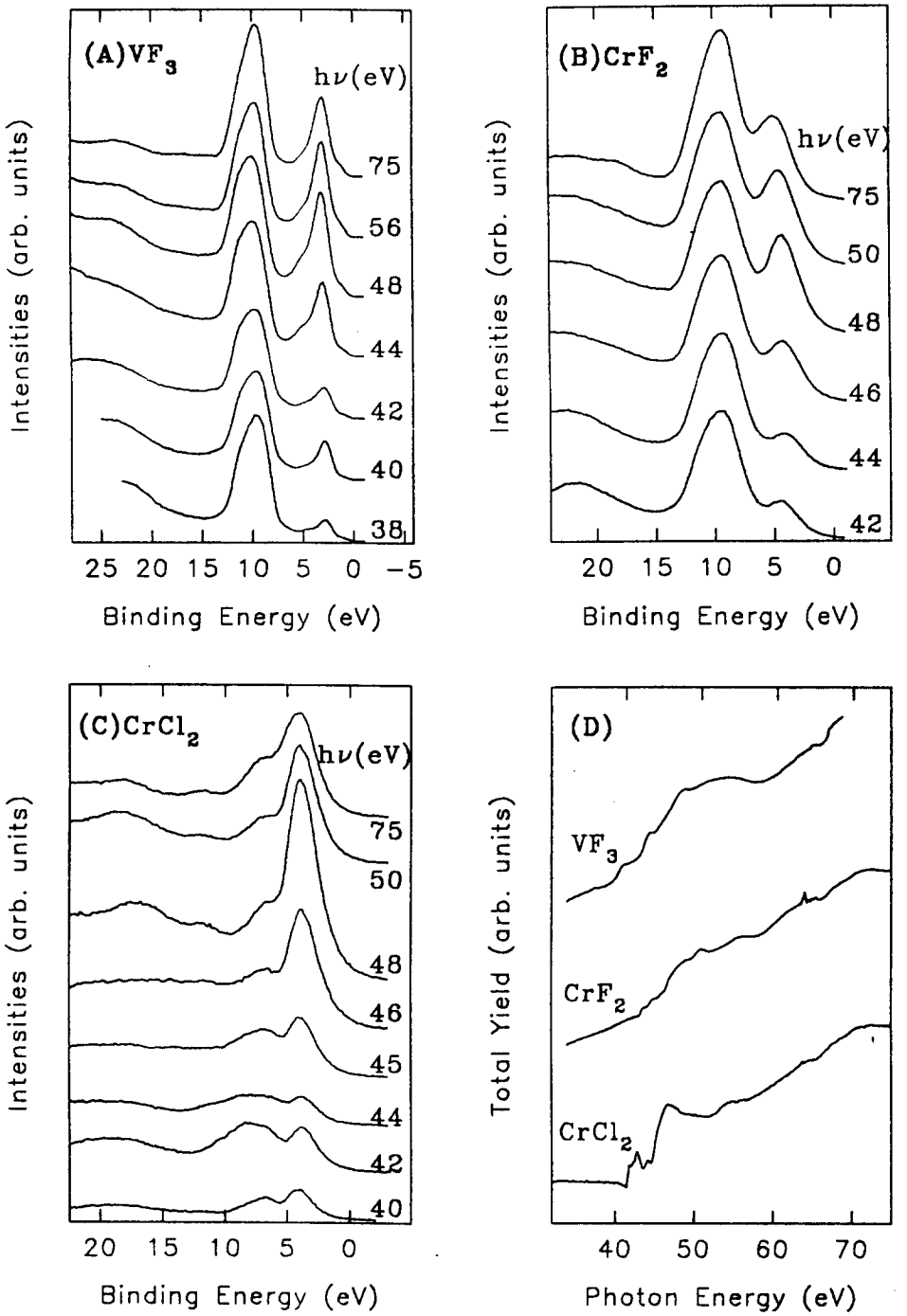

Fig.1. Energy distribution curves measured at various photon energies for VF_3 (A), CrF_2 (B), $CrCl_2$ (C), and photoelectric yield spectra of each compound (D).