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Final-state effect on X-ray photoelectron spectrum of n-doped $SrTiO_3$[1] CHUNGWEI LIN, AGHAM POSADAS, ALEXANDER DEMKOV, UT Austin, Physics Department, DEMKOV TEAM — X-ray photoelectron spectroscopy (XPS) is a widely used technique to determine the oxidation states of chemical elements. In stoichiometric $SrTiO_3$, the Ti^{4+} peak appears at a binding energy of about 459.0 eV for photoelectrons ejected from the Ti $2p$ core level. In lightly n-doped $SrTiO_3$, a weak shoulder at a binding energy of about 1.5 eV lower than the Ti^{4+} peak appears in the XPS spectrum that has been conventionally interpreted as a Ti^{3+} signal. By taking the final-state effect into account, i.e. by considering the response of the valence electrons in the presence of a core hole, we argue that such a Ti^{3+} peak does not necessarily imply the existence of spatially localized Ti^{3+} ions, and explicitly show that a spatially uniform $Ti^{(4-x)+}$ distribution also leads to the multi-peak structure. Spectra from metallic n-doped $SrTiO_3$ (e.g. La replacing Sr, Nb replacing Ti, or even oxygen vacancy doping) should be interpreted as the latter case. Several experiments based on this interpretation are discussed.

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