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Band profiles of Mott-insulator/band-insulator heterointerfaces revealed by photocurrent and electromodulation spectroscopies[1]

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Heterointerfaces of Mott insulators provide a good laboratory to explore unprecedented electronic states induced by the strong electron correlation. Although a number of intriguing phenomena have been reported so far, their fundamental origins have not been fully addressed yet. This is partly because the interface band profile, which is one of the most basic knowledge to understand the interface electronic states, is still left to be unveiled. In this study, we have investigated in detail the interface band profiles of Mott insulators employing photocurrent and electromodulation spectroscopies as well as the conventional current-voltage and capacitance-voltage characterizations. We chose p-type ($LaMnO_3$ and La_2CuO_4) and n-type ($SrMnO_3$ and Sm_2CuO_4) as the Mott insulators and these are epitaxially connected to Nb doped $SrTiO_3$ (electron-doped band insulator). The photocurrent action spectra for these heterojunctions showed negligibly-small band reconstruction as well as the existence of band bending and discontinuity in the Mott insulators, which are of no salient discrepancy with the rigid-band picture valid in the interface of conventional semiconductors [1]. However, the electromodulation spectra clearly indicate the band reconstruction in the Mott insulators [2]. The results mean that the rigid-band picture is valid in the low carrier-density regime even in Mott-insulator/band-insulator interfaces, but the intentional charge modulation leads the electron correlation effect in the Mott insulators. This work was done in collaboration with A. Sawa, J. Fujioka, M. Kawasaki and Y. Tokura.

[1] M. Nakamura *et al.*, Phys. Rev. B **82**, 201101(R) (2010)
[2] M. Nakamura *et al.*, Phys. Rev. B **75**, 155103 (2007).

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