Probing the interfacial band structure of $BaTiO_3/La_{0.8}Sr_{0.2}MnO_3$ multiferroic heterostructures with ARPES

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We have studied the interfacial band structure of $BaTiO_3$/ $La_{0.8}Sr_{0.2}MnO_3$ multiferroic heterostructures for two different ferroelectric polarizations of the $BaTiO_3$ film, with the goal to link the orbital occupancy with the variation in the magnetic properties in the $La_{0.8}Sr_{0.2}MnO_3$ layer. The ferroelectric polarization of the $BaTiO_3$ is determined by controlling the termination of the $SrTiO_3$ substrate and the heterostructures are characterized with transport and SQUID measurements, confirming the hole accumulation and depletion state of the $La_{0.8}Sr_{0.2}MnO_3$. We take advantage of soft x-ray angle resolved photoemission spectroscopy to probe the buried interfacial $La_{0.8}Sr_{0.2}MnO_3$ band structure; specifically, the $e_{g(z2-r2)}$ derived electron band and $e_{g(x2-y2)}$ hole bands are probed as we switch the ferroelectric polarization of the $BaTiO_3$ layer, changing the interfacial $La_{0.8}Sr_{0.2}MnO_3$ charge state from depletion to accumulation state.