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Equivalent Circuit Description of Non-compensated n-p Codoped TiO2 as Intermediate Band Solar Cells(IBSCs)1[1] TIAN-LI FENG, YI XIA, GUANG-WEI DENG, FENG-CHENG WU, PING CUI, HAIPING LAN, U of Sci. and Tech. of China, ZHENYU ZHANG, Oak Ridge Nat.Lab, U of Tennessee, U of Sci. and Tech. of China — The novel concept of non-compensated n-p codoping has made it possible to create tunable intermediate bands in the intrinsic band gap of TiO2 [1] as a promising materials for developing IBSCs [2]. Here we investigate the quantum efficiency of such IBSCs with or without current extracted from the intermediate bands (IBs). Using the ideal equivalent circuit model, we find that the maximum efficiency of 57% in the first case and 53% in the second are both much higher than the Shockley-Queisser limit. We also obtain various key quantities of the circuits, allowing us to simplify the IBSCs into an ordinary cell with an intrinsic resistance, a useful step in realistic development of TiO2 based solar cells invoking device integration. These equivalent circuit results are also compared with the efficiencies obtained directly from consideration of electron transition between the energy bands, and both approaches reveal the intriguing existence of double peaks in the maximum efficiency as a function of the location of IBs.

[1] Zhu W. G., et al., Phys. Rev. Lett. 103, 226401 (2009).
[2] A. Luque, et al., J. Appl. Phys. 96, 1 (2004).

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