Enhanced photocatalytic properties of electron rich W-doped $PbBi_2Nb_2O_9$ layered perovskite material under visible light irradiation

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The substitution effect of W^{6+} at Nb^{5+} site in PbBi2Nb2O9, a layered Aurivillius-phase perovskite system, has been studied and further optimized to fabricate an efficient photocatalyst. The material doped with electron donor (W^{+6}), $PbBi_2Nb_{2-x}W_xO_9$ with an optimum composition of x=0.15 exhibited a red shifted (0.14eV) band gap, generated two times higher photocurrent, and showed analogous higher quantum yield for photodecomposition of H_2O/CH_3OH solution than undoped material under visible light ($\lambda \geq 420nm$). In contrast, the material doped with hole donor (Ti^{+4}) revealed deteriorated photochemical properties. The higher electron density by n-type doping seems to be responsible for the more efficient charge separation in $PbBi_2Nb_{2-x}W_xO_9$ ($0<x<0.5$).