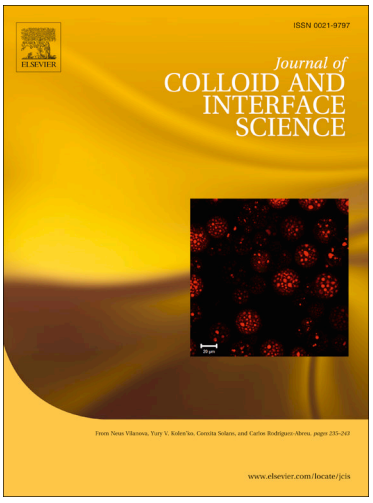

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ABSTRACT. The intriguing features of two-dimensional (2D) materials such as better charge carrier separation and abundant surface reaction sites endow them with potential applications as cocatalysts in photocatalysis. In this paper, a ternary 2D nickel hydroxide/sulfides nanosheet composed of $Ni(OH)_2$, Ni_3S_2 and Ni_xS_6 was loaded on CdS nanospheres by a simple chemical deposition route. The composition of nickel hydroxide/sulfides was determined clearly through an overall analysis using X-ray diffraction, transmission electron microscopy and X-ray photoelectron spectroscopy. Mott-Schottky, electrochemical impedance, steady-state and time-resolved photoluminescence spectroscopy were used to investigate the charge transfer process in CdS and $Ni(OH)_2/Ni_3S_2/Ni_xS_6$-CdS. The results confirm that a synergistic effect of $Ni(OH)_2/Ni_3S_2/Ni_xS_6$ on CdS has occurred under light irradiation, where the $Ni(OH)_2$ and nickel sulfides act as hole storage and surface reaction sites, respectively, to promote the charge transfer on CdS. The improved charge transfer and