DETERMINATION OF THE FLAT BAND POTENTIALS OF SEMICONDUCTOR CATALYSTS FROM CAPACITANCE-VOLTAGE MEASUREMENTS AND THEIR CORRELATION TO PHOTOCATALYTIC ACTIVITY

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The position of the flat band potential of a semiconductor in contact with an aqueous electrolyte is an important parameter which determines the relative reactivities of photogenerated charge carriers. Hence this quantity is useful to rationalize the photoreduction of N_2 to NH_3 or H_2O to H_2 on semiconductors and their doped modifications.

We have determined the capacitance-voltage of TiO_2 and several of its metal doped modifications(in the pressed pellet form)in an aqueous electrolyte of 1M NaOH at a pH of 12 using the standard three electrode assembly. The capacitance-voltage measurements were taken at 1kHz and 500 Hz using an HP 4192A LCR meter. The flat-band potential values were obtained from Mott-Schottky plots.

It was found that pure TiO_2 exhibits a flat band potential of -1.25V (vs SCE) under the conditions of the experiment in good agreement with the data obtained by previous workers. 1,2 In comparison vanadium doped TiO_2 catalyst shows more negative flat band potential of -2.65V. Other metal doped TiO_2 catalysts behave similarly. The flat band potential values can be correlated to photocatalytic N_2 reduction on these catalysts.

References: 1. Jeffrey M. Bolts and Mark S. Wrighton; The Journal of Physical Chemistry, Vol. 80, No.24, P. 2641 - 2645, 1976.
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