Hydrothermal Preparation of TiO2: AC Composite Crystalline Particulates

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A highly active, monodispersed designer crystalline nano-particulate TiO_2 has been impregnated onto the activated carbon surface under mild hydrothermal conditions (<250^{0}C, P~40 bars) which finds the application as photocatalyst. Conventionally TiO_2 is prepared through solid state reactions, etc; further the hydrothermal impregnation of such particulates onto the surface layers of activated carbon has not been carried out either to. The hydrothermal technique provides an easy and one-step method to obtain monodispersed and well crystallized desired products and also eliminates the high temperature firing or pyrolysis required by the other methods. In the present study various hydrothermal experimental parameters like the starting precursors, mineralizers, temperature, etc., were taken into consideration for the impregnation experiments. The as-prepared catalyst composite was characterized by various techniques like XRD, SEM-EDX, PALS, BET and FTIR. The XRD results showed the persisting nature of anatase phase of TiO_2 deposited on the activated carbon surface. The BET and FTIR results reveal an optimum (TiO_2 to AC ratio) conditions for the impregnation. The PALS results further confirmed that TiO_2 is impregnated onto the surface and wider pores (macro- and mesopores) of the activated carbon and the micropores do not play a significant role as far as the TiO_2 impregnation is concerned. The results of the study finally revealed that TiO_2 could be effectively impregnated onto the activated carbon surface layers under mild hydrothermal conditions and such a designer crystalline particulate composite is highly useful for the environmental issues such as degradation of hazardous organics/wastes, treatment of effluents, air purification and so on.

Keywords: hydrothermal impregnation, photocatalyst, TiO_2: AC composite