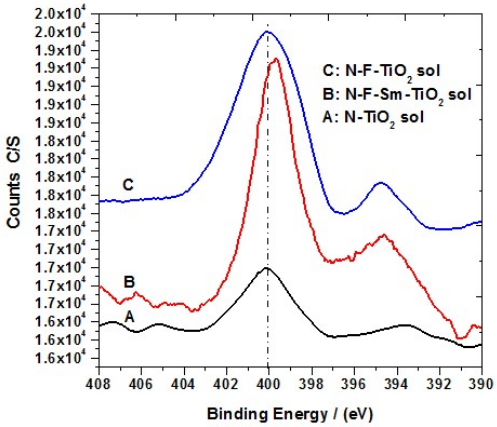

Figure 6 N_{1s} XPS spectra of N-F-Sm-TiO_2 sol

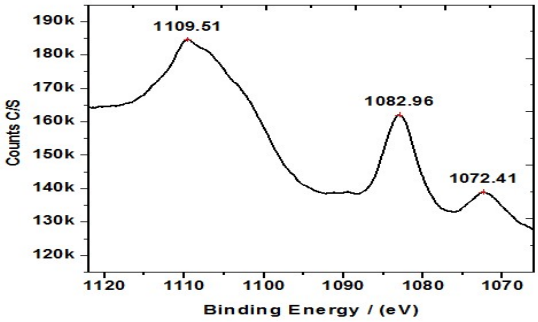

Figure 7 shows the Sm $_{3d}$ XPS spectra of N-F-Sm-TiO_2 sol sample

D. Photocatalytic activity of N-F- Sm-TiO_2 sol

1) Effects of Sm/Ti atomic ratio in N-F- Sm-TiO_2 on the 4-chlorophenol degradation

As shown in Figure 8, the photocatalytic degradation of 4-chlorophenol by a series of N-F- Sm-TiO_2 (the ratio of Sm / Ti (at.)) =0.001, 0.002, 0.003, 0.005, 0.007, 0.008, 0.010) samples were prepared by modified hydrothermal process at 130 °C photocatalytic activity of N-F- Sm-TiO_2 increased and reach the maximum at Sm : Ti = 0.005(at.). The increase in photocatalytic activity was ascribed to Sm^{3+} ion acts as electron traps and thus facilitated the charge separation.

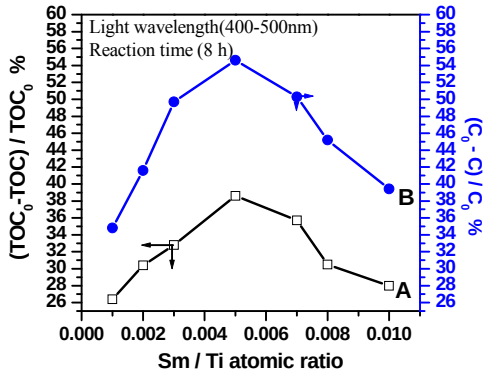

Fig. 8 Effects of Sm/Ti atomic ratio onphotoactivity of N-F-Sm-TiO_2

With the increase of further samarium concentration, when Sm : Ti (at.) was more than 0.005, the degradation percentage of 4-chlorophenol started to decrease, which means that more doping may convert the dopant from the trap center to the combination center of the electron and the hole, thereby resulting in a decrease in the photocatalytic ability of N-F-Sm-TiO_2.

2) Influence of N，F and Sm co-doping in TiO_2 on the 4-chlorophenol degradation

The photocatalytic activities of the Sm-TiO_2, F-TiO_2, N-TiO_2, N-F-TiO_2, and N-F-Sm-TiO_2 were evaluated by photodegradation of 4-chlorophenol, which was shown in Figure 9. The N-F-Sm-TiO_2 presented good activity for the degradation of 4-chlorophenol, the degradation rate could be up to 42.4% after photoreaction for 10 h; Under the same condition, the photodegradation rate of 4-chlorophenol degraded by Sm-TiO_2, F-TiO_2, N-TiO_2,was 0.5%, 1.2% and 16.7% respectively. The co-doping of nitrogen，fluoride and samarium could enhance its activity of catalyst significantly, and it was much higher than that of only Sm atoms doped TiO_2 or only nitrogen atoms doped TiO_2.

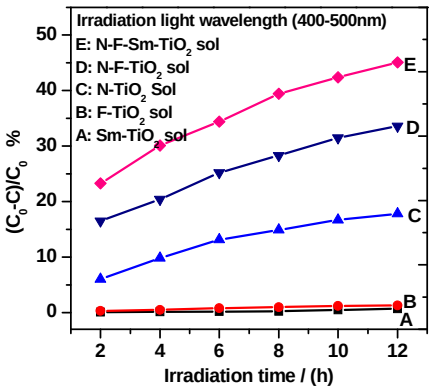

Figure 9 Photocatalytic activities of TiO_2 sol

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