

REDUCTION OF N_2 TO NH_3 BY Ti^{3+} IN
HOMOGENEOUS AND HETEROGENEOUS
MEDIA AND ITS PHOTOENHANCEMENT

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Reduction of dinitrogen to NH_3 and N_2H_4 in protic media by the hydroxides of $Ti(III)$, $Cr(II)$ and $V(II)$ with $Mo(III)$ participation have been studied by Shilov and his co-workers¹. Similar work by Schrauzer has shown that N_2 reduction can be carried out using the $Ti(OH)_3$ - $Mg(OH)_2$ system, while Mg^{2+} is not required for the reduction of acetylene to ethylene.

We have found that in contrast to the observations of Schrauzer, freshly precipitated $Ti(OH)_3$ is capable of reducing N_2 to NH_3 without $Mo(III)$ or Mg^{2+} participation. The yields of NH_3 obtained are however enhanced when mixed $Ti(OH)_3$ - $Mg(OH)_2$ is used. Furthermore, upon irradiation with light from a medium pressure Hg arc lamp, there was a distinct photoenhancement of the ammonia yields. Another interesting feature is that the yields are enhanced when the irradiation periods were interrupted with occasional dark periods. The results can be explained on account of the observed semiconductor property of $Ti(OH)_3$ and the initial accumulation of N_2H_4 with further disproportionates to give ammonia.

References:

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