可視光応答型半導体光触媒を用いる汚染水中3価ヒ素の酸化・吸着処理法の開発

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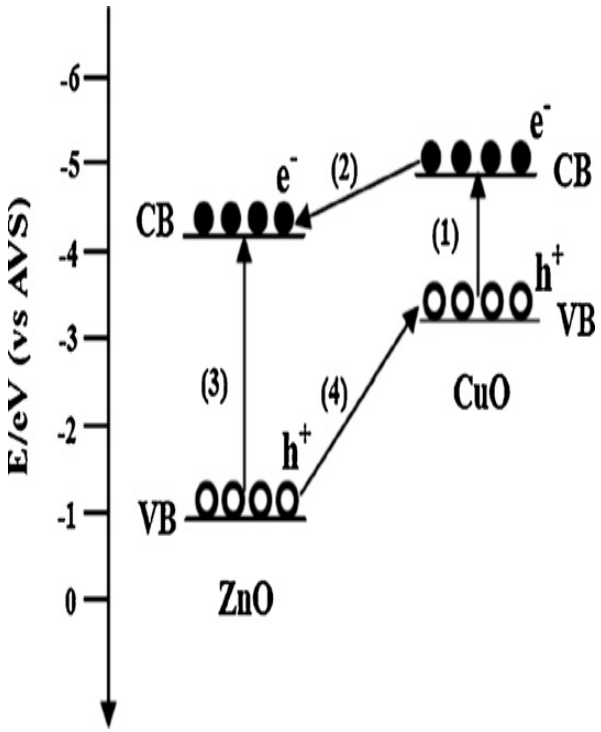
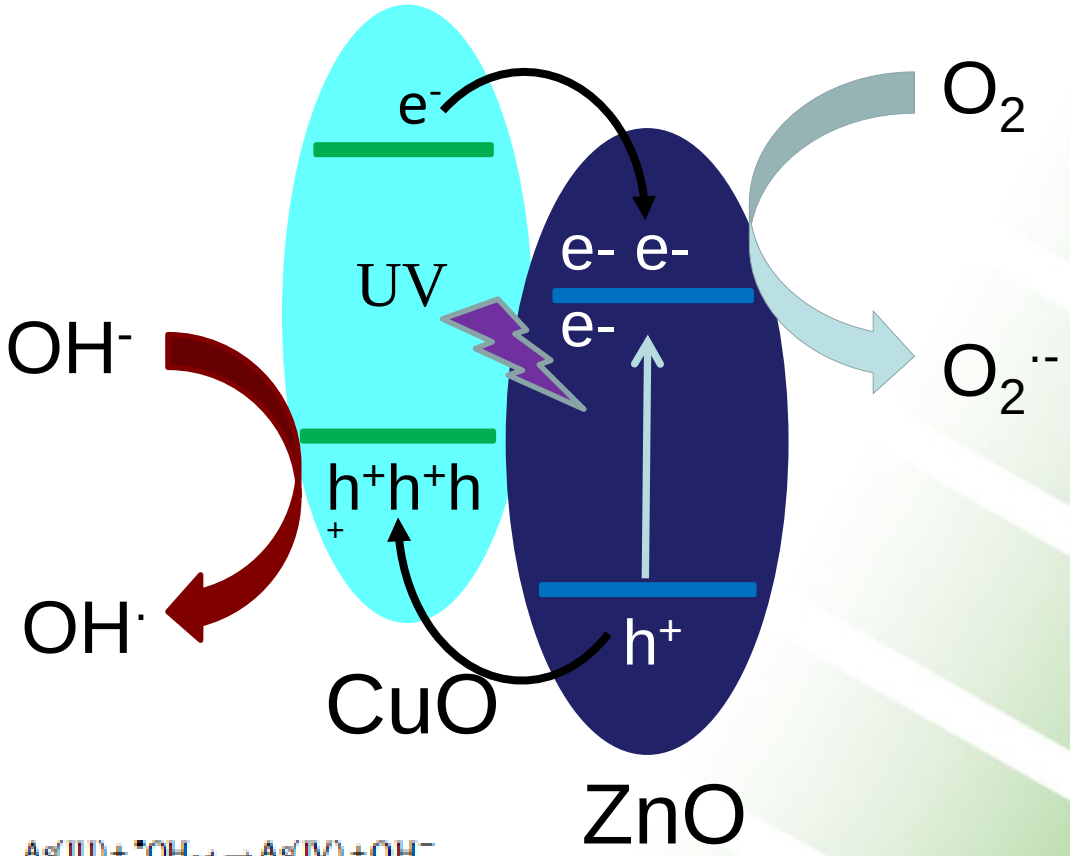
世界のヒ素汚染の現状

As(III)からAs(V)への酸化と吸着除去

- ヒ素（III）は、ヒ素（V）と比較して毒性が25～60倍高い。
- バングラデシュを中心として、地下水のヒ素（III)汚染が深刻である。
- ヒ素（V）に酸化し、さらに簡単に除去する手法の開発が求められている。
- 本研究では、可視光応答型半導体光触媒を開発に成功し、ヒ素の酸化・吸着除去に応用した。
- Asia Pacific Society of Material Research学会から、2018年2月にResearch Awardを受賞。





$$As(III) + {}^{\bullet}OH_{ad} \rightarrow As(IV) + OH^{-}$$

$$As(IV) + {}^{\bullet}OH_{ad} \rightarrow As(V) + OH^{-}$$

$$As(III) + h_{VB}^{+} \rightarrow As(IV)$$

$$As(IV) + h_{VB}^{+} \rightarrow As(V)$$

$$As(IV) + O_2 \rightarrow As(V) + O_2^{\bullet -}$$

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Photocatalytic oxidation and simultaneous removal of arsenite with CuO/ZnO photocatalyst

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ABSTRACT

We investigated the photocatalytic oxidation and simultaneous removal of arsenite in synthetic aqueous As solution with high concentration. The process was performed by using CuO/ZnO nanoparticles under UV irradiation at around neutral pH. The effects of CuO addition, initial arsenite concentration and photocatalyst loading on the treatment efficiency were investigated. Adsorption of arsenic onto catalytic surface was evaluated with fourier-transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS). Batch results showed it that CuO has a significant effect on the photocatalytic performance of ZnO. The rate constant of photocatalytic oxidation with CuO(20%)/ZnO was 4 times better than those obtained with pristine ZnO. The removal amount ($mg\,g^{-1}$) of arsenic increased with an increase in initial arsenic concentration. As(III) solution of $30\,mg\,L^{-1}$ could be completely removed with photocatalyst of $0.67\,g\,L^{-1}$ during 10 h of irradiation time. The maximum As(III) removal amount by photocatalytic oxidation and simultaneous removal was 6.5 times larger relative to that observed in the adsorption in dark. The excellent photocatalytic oxidation and high uptake performances make CuO/ZnO a potentially attractive candidate for the removal of As(III) from highly arsenic contaminated water.

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