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Dye Decolorization Under Visible Light Irradiation Using Bismuth Subcarbonate

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INTRODUCTION & AIM

$Bi_2O_2CO_3$ (BOC)

Advantage

- Bi has low toxicity and environmental impact.
- It consists of $[Bi_2O_2]^{2+}$ and $[CO_3]^{2-}$ layers, which form an internal electric field that is beneficial for improving the separation efficiency of photogenerated carriers.

Disadvantage

- Responds only to ultraviolet light due to wide band gap.
- High recombination rate of photogenerated electron-hole pairs.
- Few reaction sites, low adsorption efficiency.

In this study, a catalyst was prepared by treating BOC with nitric acid and adding a Br source. Then, its photocatalytic activity was evaluated in a dye decolorization experiment.

METHOD

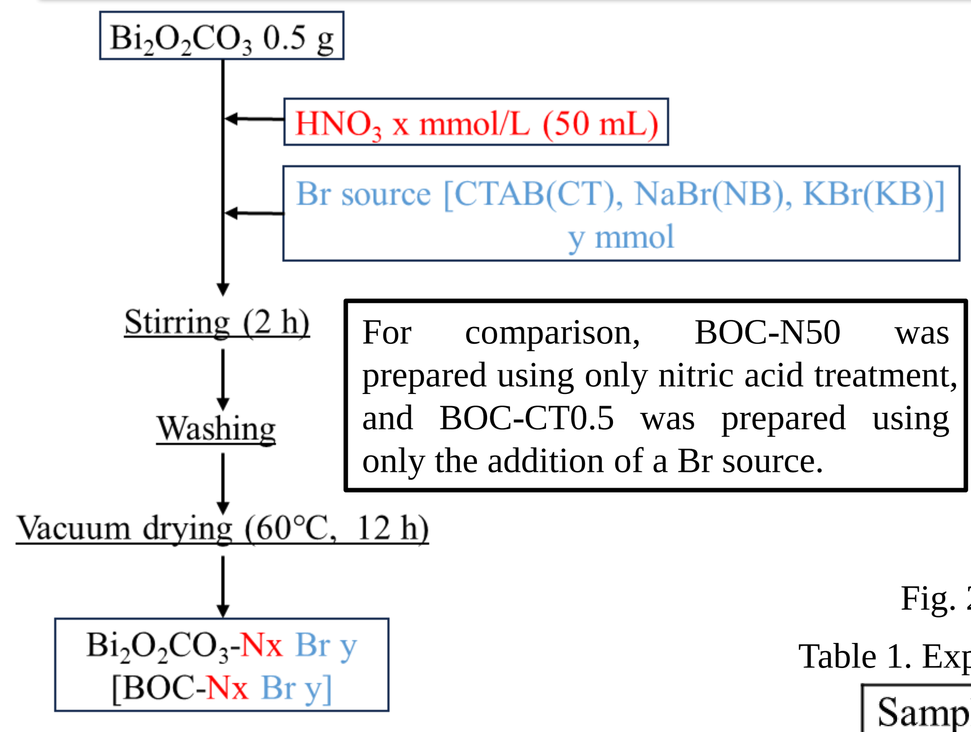

Fig. 1. Preparation of photocatalysts.

※CTAB: Hexadecyltrimethylammonium Bromide
BQ: p-Benzoquinone
TBA: tert-Butyl Alcohol
AO: Ammonium Oxalate

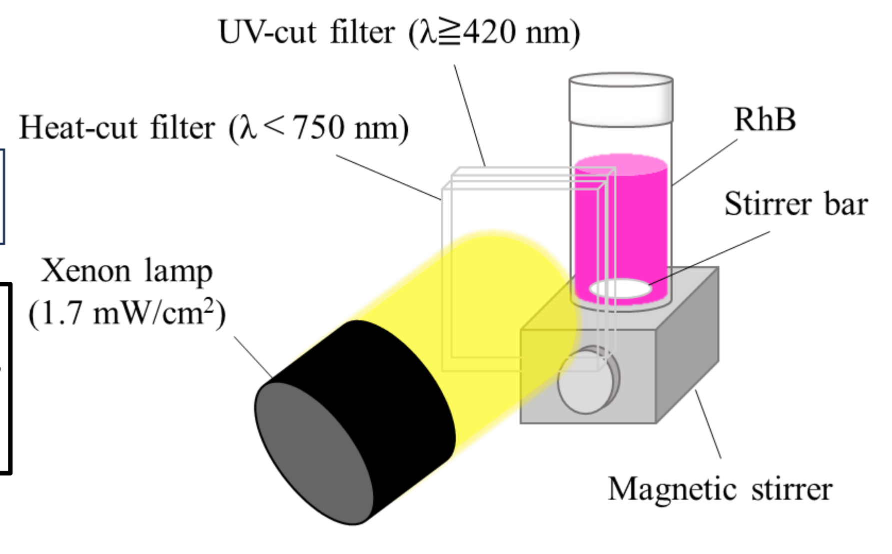

Fig. 2. Photoreactor in photocatalytic decolorization of RhB.

Table 1. Experimental conditions of photocatalytic decolorization of RhB.

Sample	10 ppm Rhodamine B (RhB) 35mL
Photocatalyst	20 mg
Light source	Xenon lump (λ ≧ 420 nm)
Adsorption time	60 min
Detection	554 nm
Detector	UV/vis spectroscopic detector

RESULTS & DISCUSSION

XRD & XPS

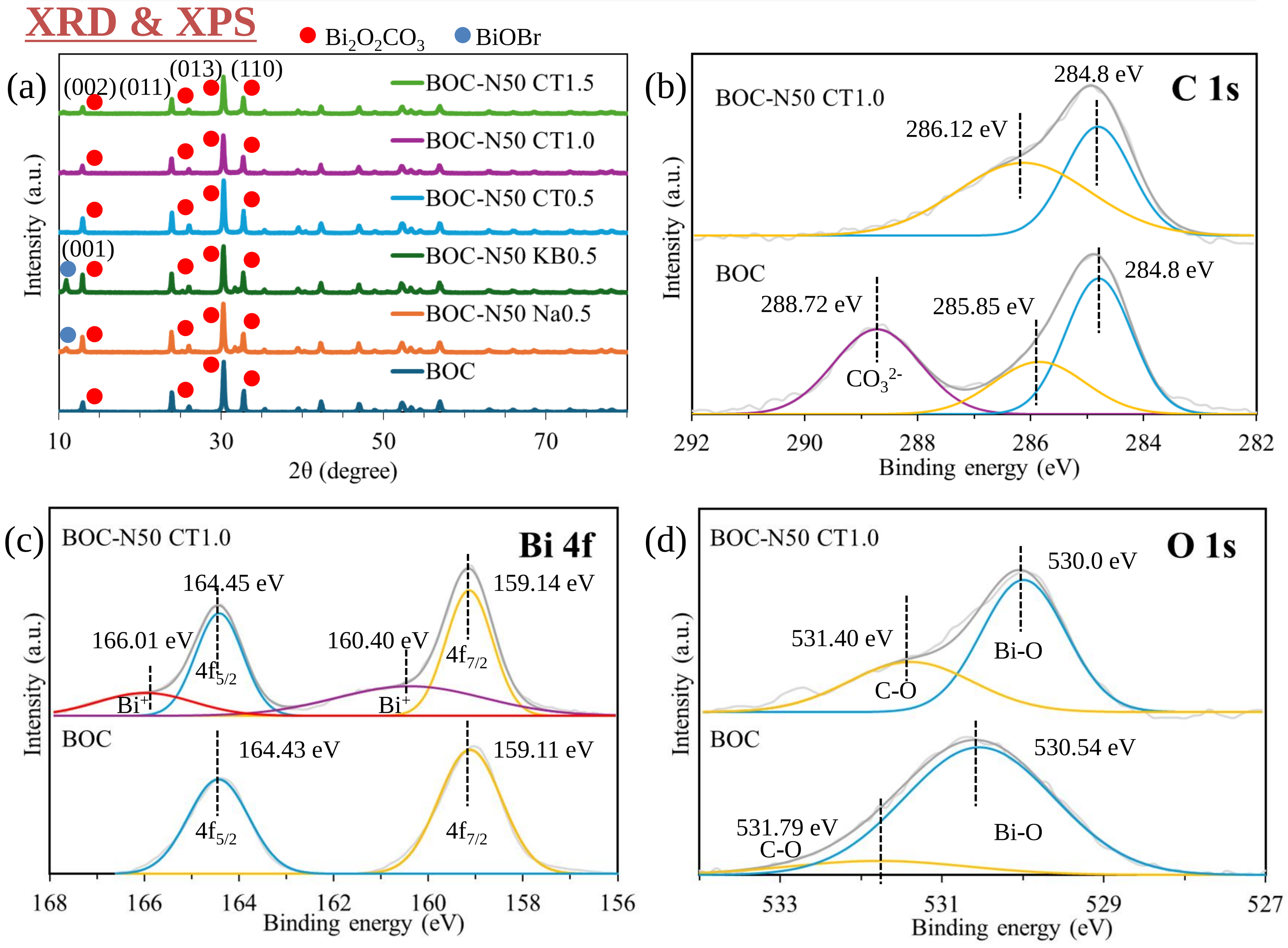

Fig. 2. (a) XRD patterns of different photocatalysts and XPS spectra of BOC and BOC-N50 CT1.0; (b) C1s, (c) Bi4f, (d) O1s.

DRS & PL

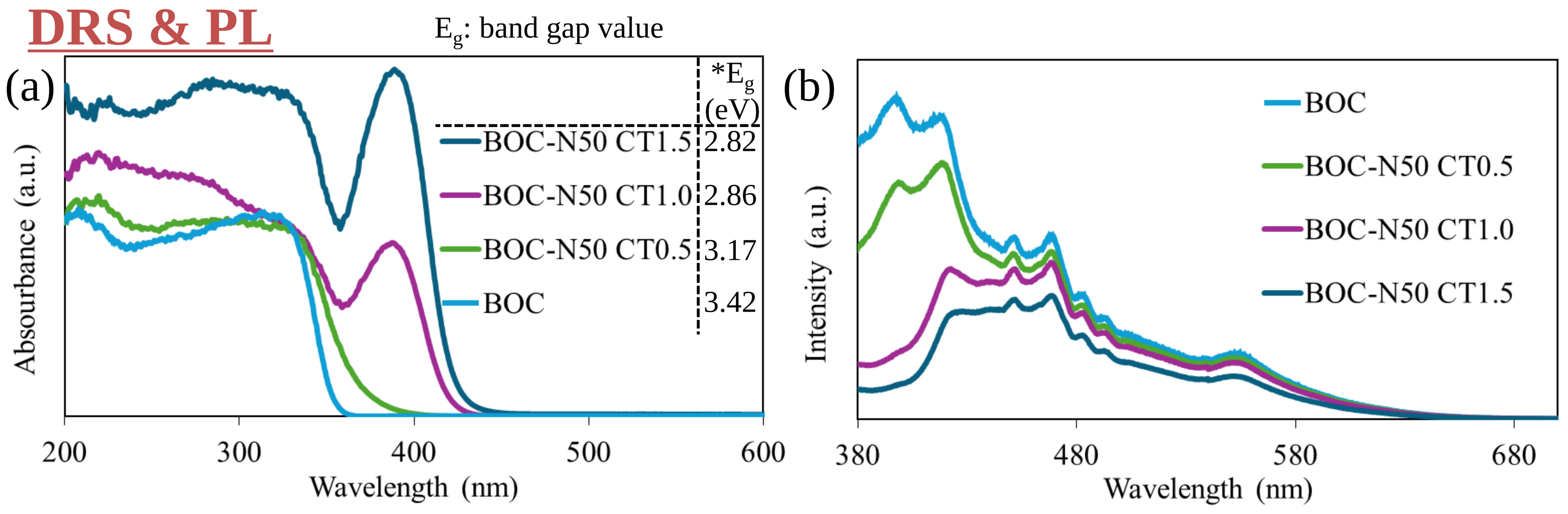

Fig. 3. (a) DRS and (b) PL spectra of different photocatalysts.

SEM

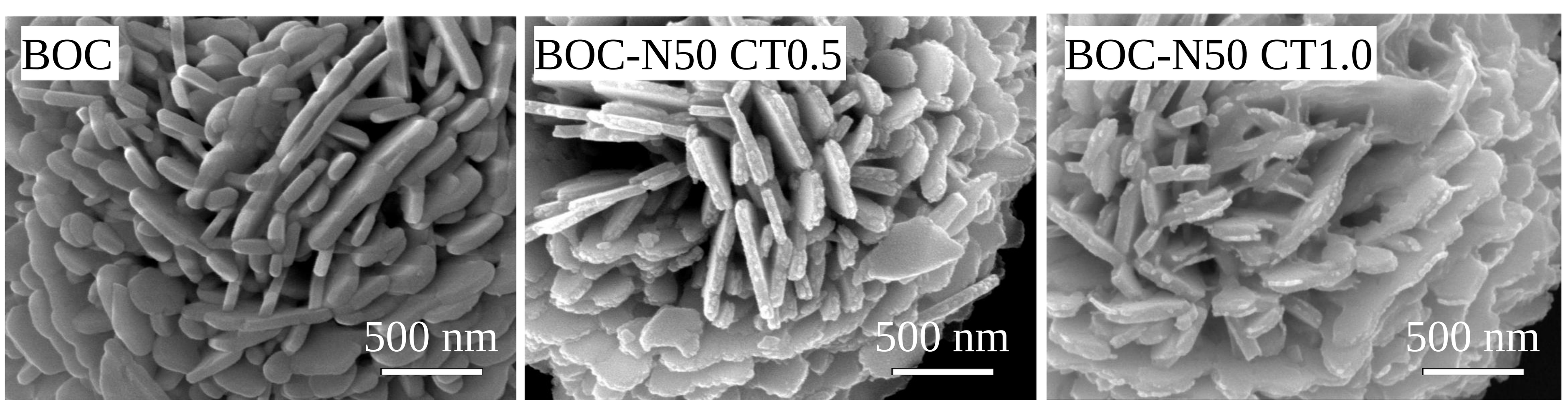

Fig. 4. SEM images and BET surface areas of BOC, BOC-N50 CT0.5, and BOC-N50 CT1.0.

RESULTS & DISCUSSION

Decolorization Results

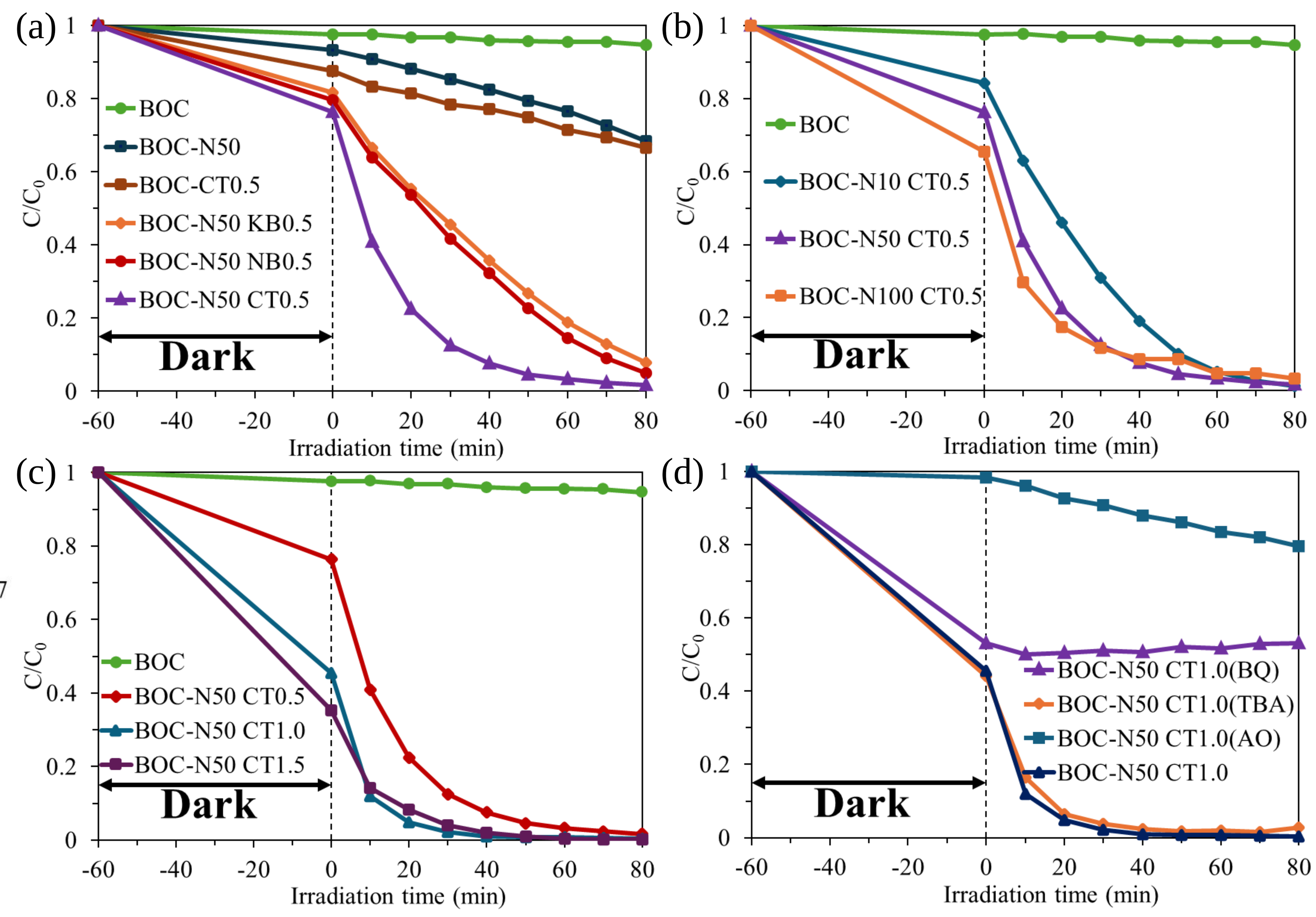

Fig. 5. Comparison of decolorization results with the effects of (a) nitric acid treatment and Br source, (b) nitric acid concentration, (c) amount of CTAB added, and (d) addition of a scavenger.

MECHANISM

Mechanism

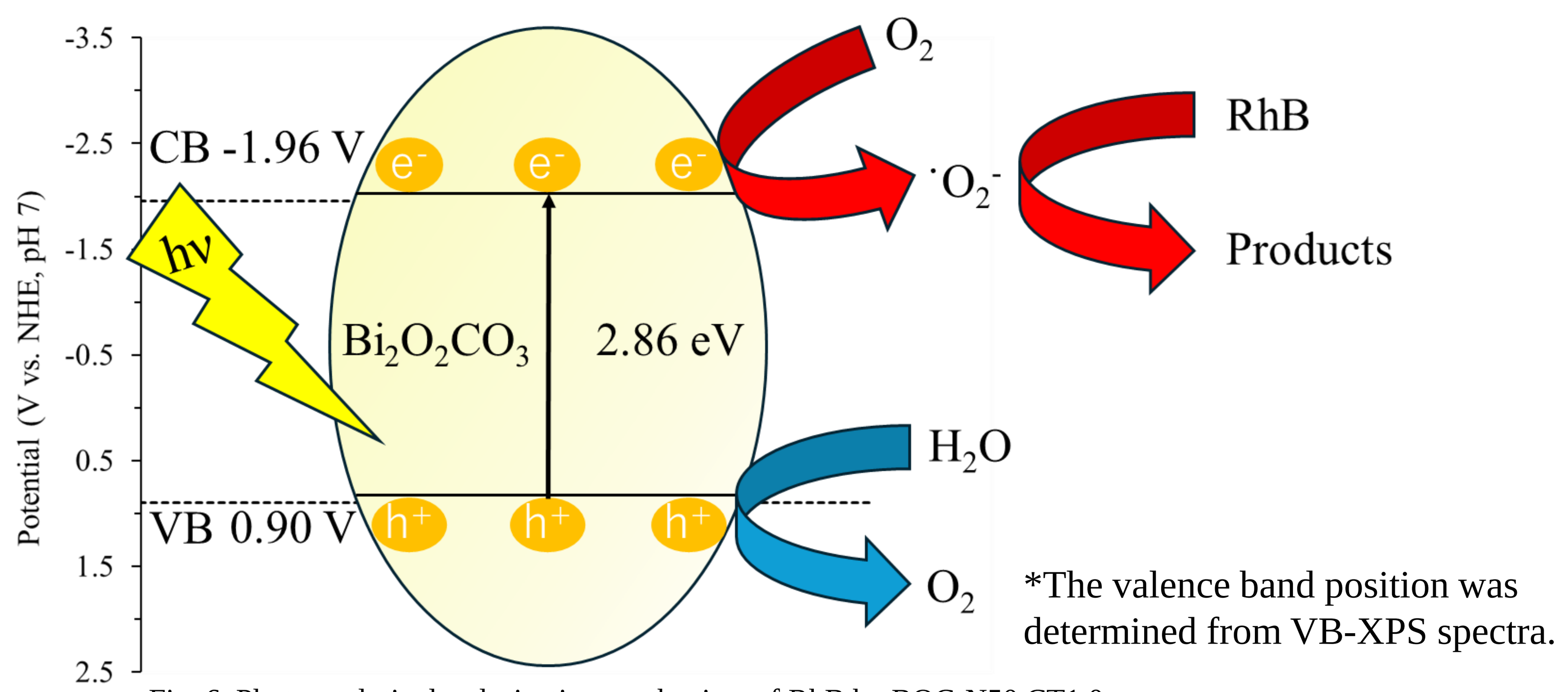

Fig. 6. Photocatalytic decolorization mechanism of RhB by BOC-N50 CT1.0.

CONCLUSION

- BOC was treated by adding nitric acid and a Br source.
- BOC-N50 CT1.0 had a smaller band gap and a lower recombination rate of photogenerated electron-hole pairs, and showed the highest photocatalytic activity.
- The results of the scavenger experiments demonstrated that $.O_2^-$ and h^+ were the main active species.

FUTURE WORK / REFERENCES

- Further narrowing of the band gap and reduction of the recombination rate.