CYSS
CataLight Young Scientist Symposium
synthesis • theory • characterization • application

Transforming bimetal zinc nickel oxide to oxysulfide photocatalyst with its exceptional performance to evolve hydrogen

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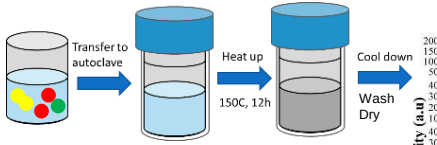
1. Introduction

Photocatalytic hydrogen production with semiconductor catalyst is one of the best techniques to produce green hydrogen gas. This research investigated the effect of sulfur content on phase transformation of bimetal zinc nickel oxide to oxysulfide, which simultaneously affected the performance on photocatalytic hydrogen production. Different amounts of sulfur precursor (0, 0.25, 0.5, 0.75 and 1 mmol) were added to the bimetal oxide during the hydrothermal synthesis. Our design of ZnNiOS had the exceptionally high photocatalytic activity as compared to single-phase oxide and sulfide.

2. Methods

Synthesis ⇨ **Hydrothermal**



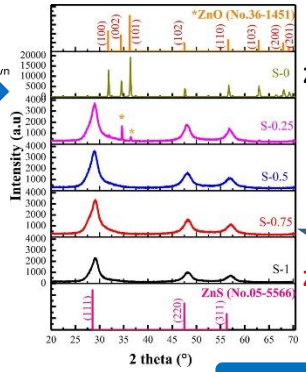
C_2H_5NS $Zn(OAc)_2$ $NiCl_2$

Characterizations

#XRD ⇨ Crystal property
#SEM&TEM ⇨ Nanostructure
#GC-TCD ⇨ Hydrogen amount

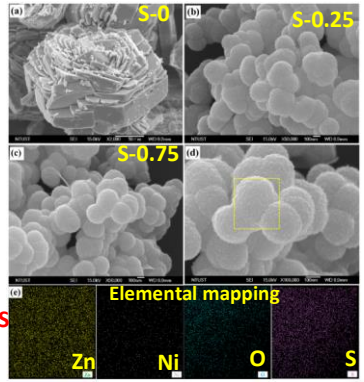
3. Results & Discussion

3.1 X-ray diffraction

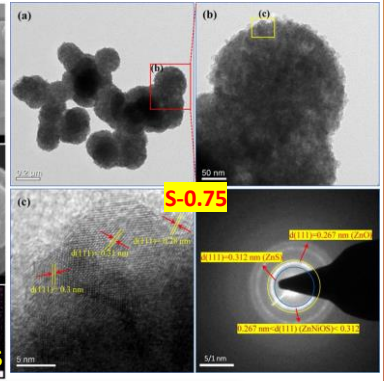


ZnNiO → More sulfur → ZnNiOS

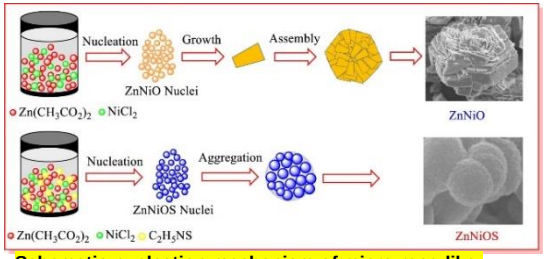
3.2 SEM images



3.3 TEM analysis

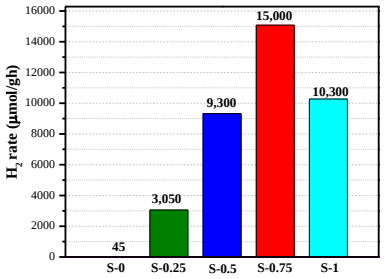


3.4 Nucleation mechanism

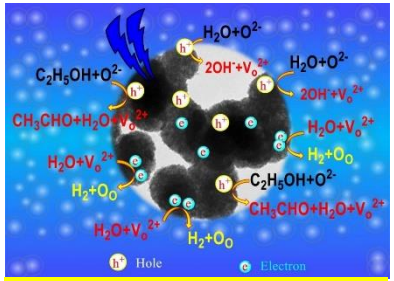


Schematic nucleation mechanism of micro rose-like ZnNiO and nano-sphere ZnNiOS particles

3.5 Photocatalytic H_2 rate



3.6 Kinetic mechanism



Proposed reaction mechanism of hydrogen generation based on oxygen vacancies

4. Conclusions

- ✓ Bimetal ZnNiO has been transformed to oxysulfide (ZnNiOS) by adding sulfur during the hydrothermal.
- ✓ Sulfur not only affected the morphology and crystal structure, but also remarkably improved the hydrogen production rate.
- ✓ The highest hydrogen production rate of 15,000 μmol/gh was achieved by S-0.75, which was 333-fold than ZnNiO.