



La(M,Ti)(O,N)3 (M = Zn, Ga) as visible light-driven photocatalyst for water splitting

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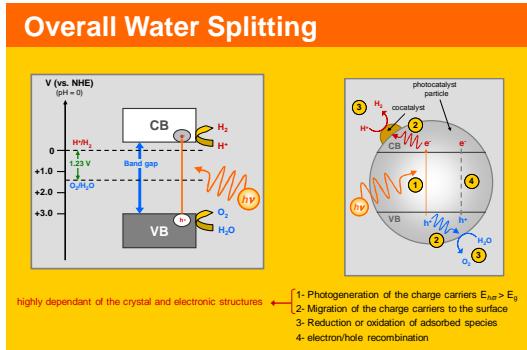
$\text{La}(\text{M},\text{Ti})(\text{O},\text{N})_3$ ($\text{M} = \text{Zn, Ga}$)

as visible light-driven photocatalyst for water splitting

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Two of the main studied oxynitride compositions for water splitting

(Zn,Ga)(O,N)
wurzite-type d¹⁰ configuration
► absorption at longer wavelengths
► efficient only for half reactions

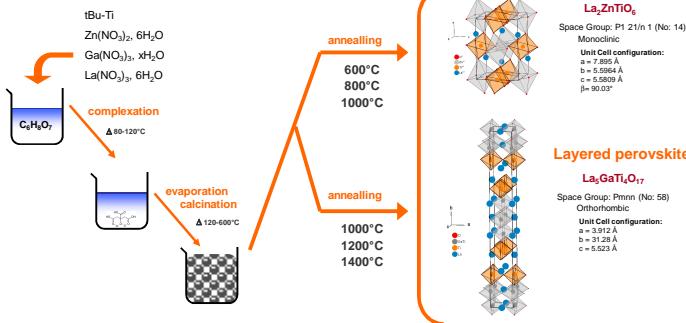
Combining d⁰ and d¹⁰ within the same oxynitride composition

efficient for overall water splitting
► absorption at short wavelengths

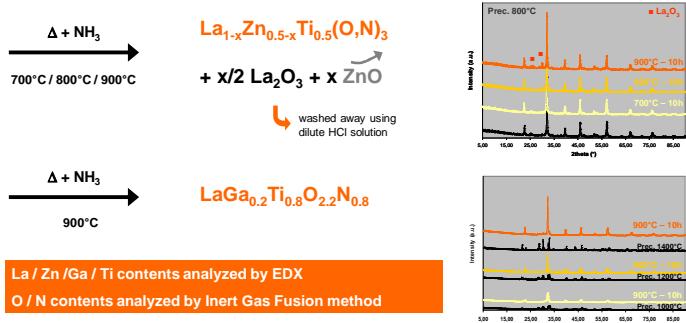
LaTiO₂N
perovskite-type d⁰ configuration

OVERVIEW

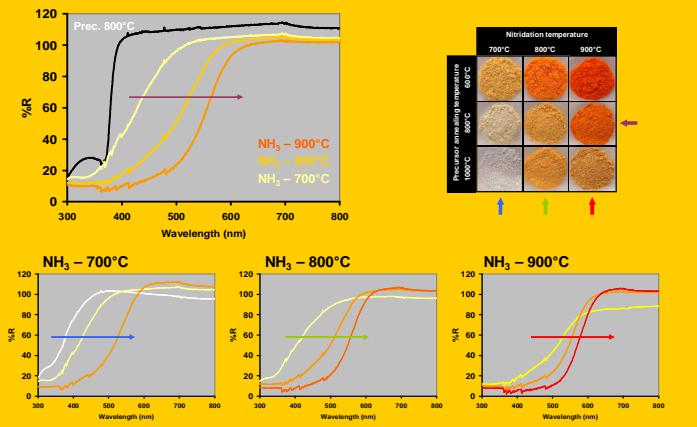
Oxide precursors / Amorphous citrate route



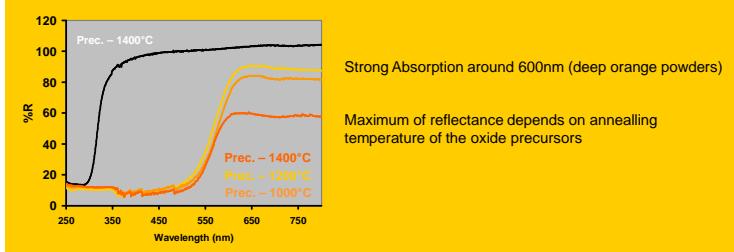
Oxynitrides synthesis / Ammonia flow nitridation



La(Zn,Ti)(O,N)₃ Absorption Properties



LaGa_{0.2}Ti_{0.8}(O,N)₃ Absorption Properties



- Control of the optical absorption with the chemical composition and annealing conditions
- Increase of maximum of reflectance at high wavelengths with Zn/Ti and Ga/Ti substitutions
- Good compromise between visible light absorption and crystallinity of the oxynitride for:

LaZn_{0.4}Ti_{0.6}(O,N)₃ – prec. 800°C / NH₃ – 900°C

LaGa_{0.2}Ti_{0.8}(O,N)₃ – prec. 1200°C / NH₃ – 900°C

Photocatalysis Results

[Hydrogen evolution]
Catalyst: 0.2 g (3 wt % Pt from H₂PtCl₆) (loaded by impregnation followed by H₂-reduction at 300 °C for 1 h, batch system) + 0.2 g La₂O₃ as a buffer
Aqueous methanol solution (20 vol%, 200 mL)

[Oxygen evolution]
Catalyst: 0.1 g (2 wt% Co₃O₄ from Co(NO₃)₂) (loaded by impregnation followed by calcination in air at 200°C for 1 h) + 0.2 g La₂O₃ as a buffer
Aqueous silver nitrate solution (0.02 M, 200 mL)

