Ammonia Oxidation at High Pressure as a Carbon Free Fuel

BACKGROUND AND OBJECTIVES

Objective: Increasing knowledge on the conversion of NH₃ at high pressures, as well as its mixtures with CH₄ and H₂ under different operating conditions

Turning NH₃ into a suitable alternative fuel

Disadvantage: nitrogen oxides (NOₓ) can be formed from NH₃ oxidation [4]

Global chemical reactions for the formation of N₂ and NOₙ

Security of energy supply and existing facilities for its transportation.

Ammonia oxidation


Turning NH₃ into a suitable alternative fuel

Study of NH₃ as an alternative fuel for several applications including energy storage, transportation and gas turbines [1, 2]

Conclusions

- NH₃ oxidation starts at lower temperatures, about 355°C before, for both NH₃-CH₄ and NH₃-H₂ mixtures (cases B and C) mixes compare to pure NH₃ (case A).

- Mixing NH₃ with CH₄ or H₂ improves reaction behaviour, consuming practically all the NH₃ at temperatures at which the oxidation of pure NH₃ has not yet started, but this mixture oxidation present N₂O emissions.

REFERENCES


EXPERIMENTAL RESULTS AT HIGH PRESSURE

Conditions: 40 bar of pressure, temperatures from 500°C to 900°C, gas flow = 1000 ml/min, residence time = 0.524 min and (1) lambda (λ) = 3.

Case A) 1000 ppm of pure NH₃; oxidation reaction of NH₃ started at 875°C.

Case B) & C) NH₃-CH₄ and NH₃-H₂ mixtures (1000 ppm for each component); oxidation reaction of NH₃ started at 530°C.

Methodology

Experimental Conditions

- Pressure: 10 – 40 bar
- Temperature range: 400 – 900°C
- Lambda: 1 – 3
- [NH₃] = 1000 ppm
- [CH₄] = 1000 ppm
- [H₂] = 1000 ppm

CONCLUSIONS

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