



船舶低碳低速机面临的挑战

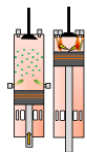
中船动力（集团）有限公司

China Ship Power (Group) Co. LTD Co.,Ltd.

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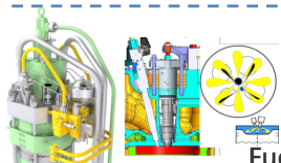
Challenges

氨燃料发动机 Ammonia engine



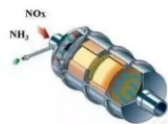
燃烧系统
Combustion system

燃点高、火焰传播速度慢、可燃范围窄、热值低，需开展大量研究分析缸内燃烧模式。



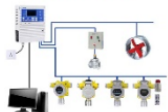
燃料喷射
Fuel injection system

喷雾雾化特性不明，需开展大量研究确定燃料喷射参数及装置结构。



排放物
控制系统
Emission control system

NOx排放高，NH3逃逸，需要考虑NOx与NH3的协同处理方案。



控制及
安保系统
Control and security system

存在毒性，需对氨泄露进行控制，并配备紧急处理系统与措施。



耐腐蚀性材料
Anticorrosion material

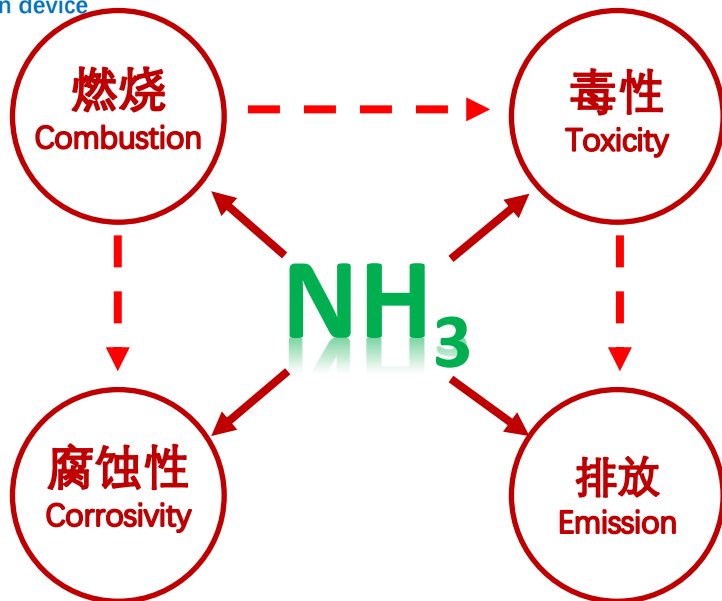
存在腐蚀性，对缸内合金部件、垫圈、密封件材料提出较高要求。

大空间火焰传播慢，运行工况窄，功率限制，点火装置复杂。

Low flame speed, Narrow operating condition, Power limitation, Complex ignition device

防泄漏措施或装置复杂

Complex leakage prevention measures or devices



腐蚀部分金属

Engine component corrosion

后处理装置复杂

Complex after-treatment device

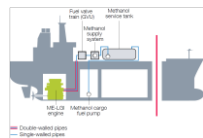
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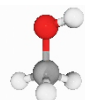
□ 甲醇燃料发动机 Methanol engine



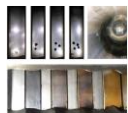
燃料喷射系统
Fuel injection system



燃料供给系统
Fuel supply system



排放后处理系统
After-treatment system



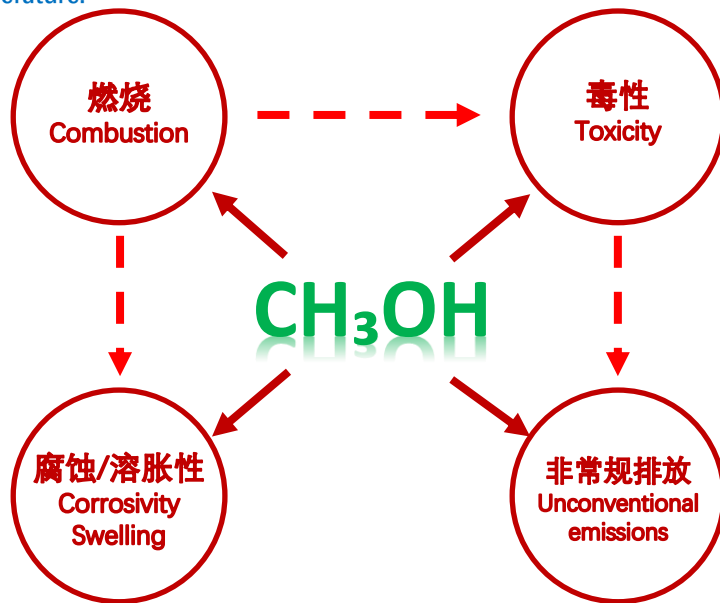
材料、润滑、密封
Materials, lubrication, sealing



安保措施
Security measures

热值较低、自点火性能差，汽化温度低。
Low heat value, poor self-ignition performance, low vaporization temperature.

防泄漏措施或装置复杂
Complex leakage prevention measures or devices



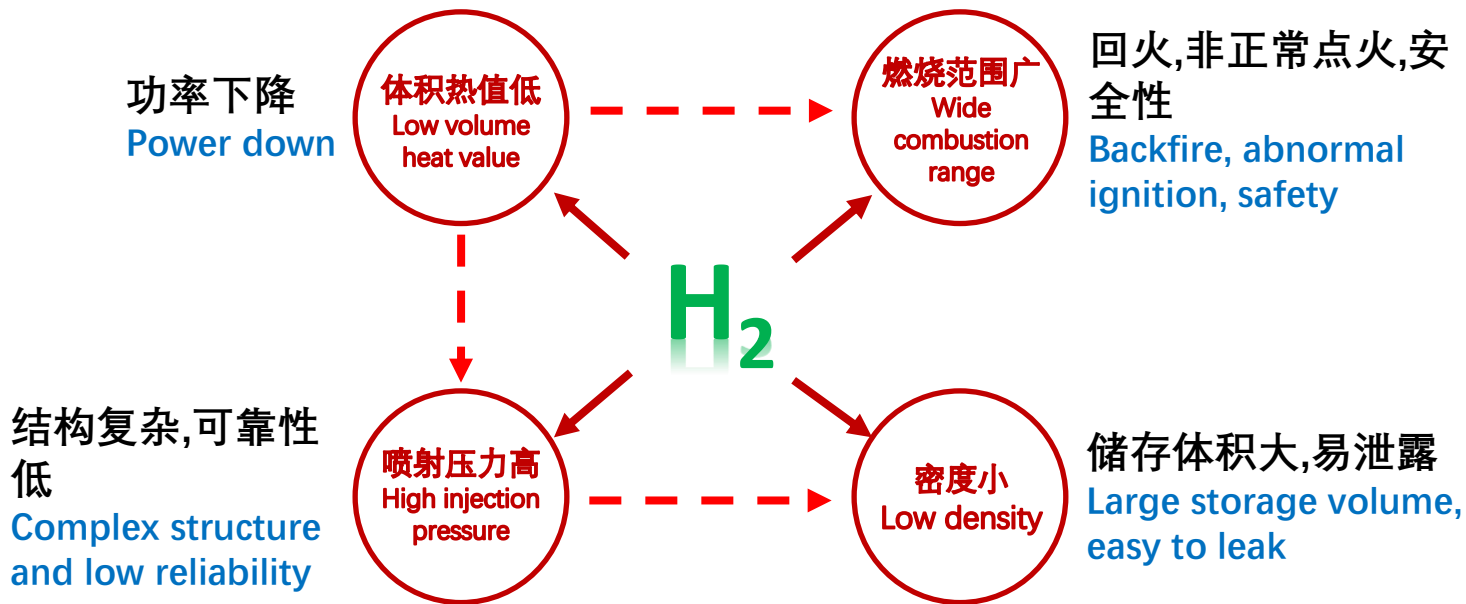
受热件、密封件材料需更换
Heating parts and sealing parts materials need to be replaced

未燃甲醇及醛类
Unburned methanol and aldehydes

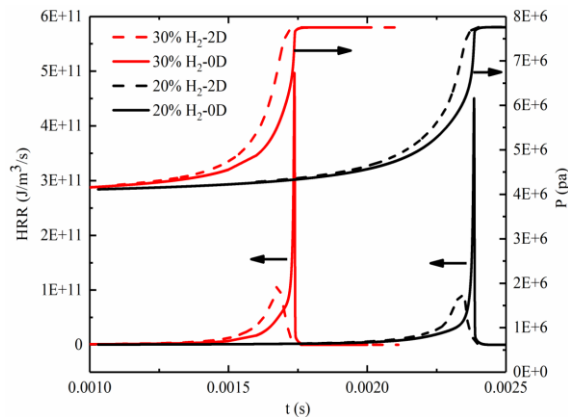
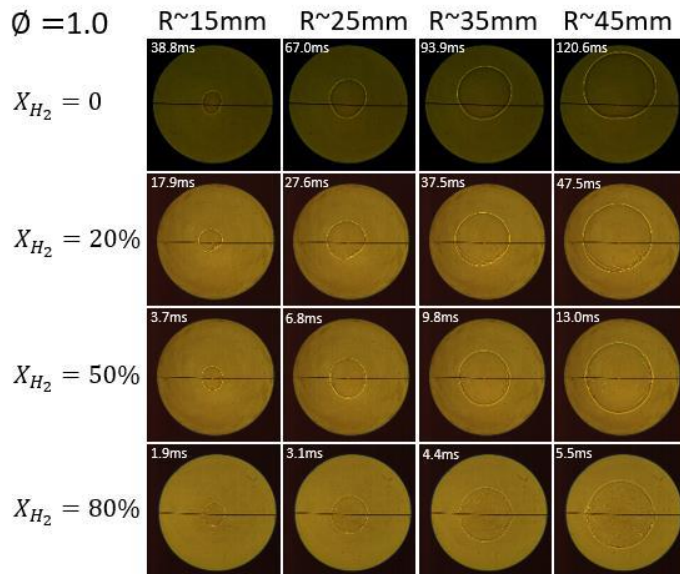
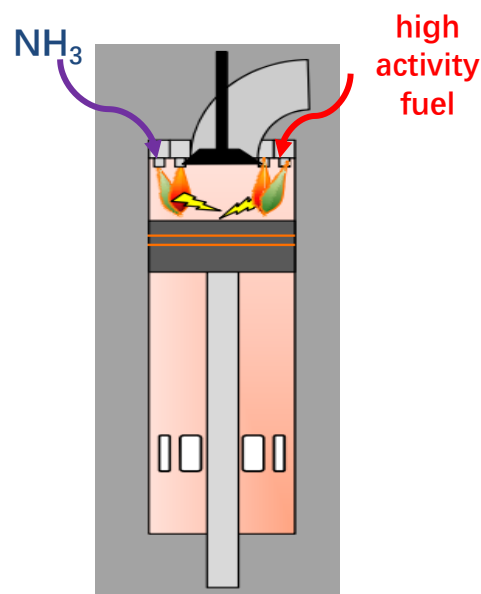
船舶低碳低速机面临的挑战

Challenges

□ 氢燃料发动机 Hydrogen engine



□ 燃烧 Combustion

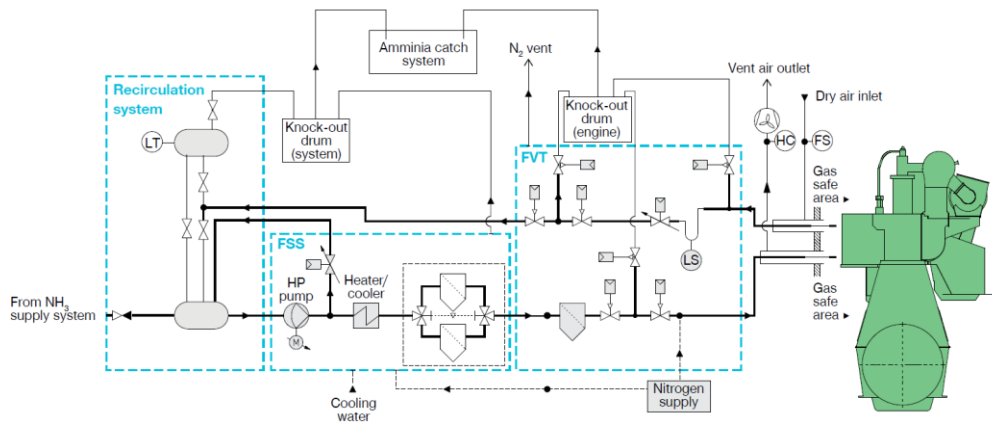


随着 H_2 比例提升，燃烧显著加速

◆ 使用引燃燃料或者使用高活性、高火焰传播速度燃料掺烧，提高压缩比和点火能量，加速氨燃烧。

Use ignition fuel or high activity fuel, improve the compression ratio and ignition energy, accelerate the combustion of ammonia.

❑ 腐蚀性 Corrosivity



● 燃料供给系统 Fuel supply

- ◆ 燃料再循环系统及双壁管路系统
- ◆ 氮气清洗系统、双层通风系统及氨捕集装置

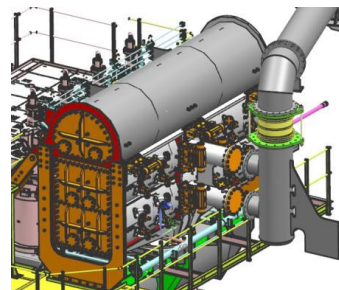
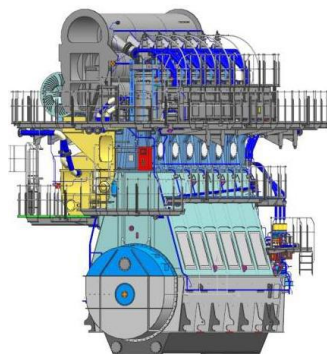
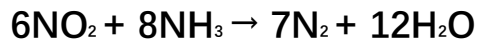
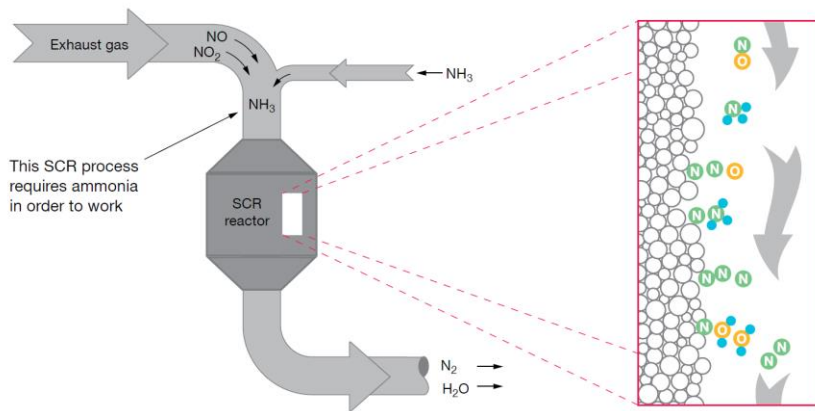
● 缸内燃烧室部件材料 Engine material

- ◆ 耐腐蚀性活塞、活塞环、缸盖、缸套设计
- ◆ 耐腐蚀润滑油方案

排放 Emission

● 氨氮协同控制系统

Cooperative control system for ammonia and nitrogen



集成机载SCR系统

Integration Selective catalytic reduction system

□ 毒性 Toxicity

● 氨监控、捕集及紧急通风系统

Ammonia monitoring, capture and emergency ventilation system

≥5ppm: can be smelled
≥30ppm: dangerous
≥100-200ppm: Irreversible health effect

外部泄露

External leaks



监控/报警装置

Monitoring and alarm device



通风装置

Ventilation



防毒措施

Protective measures

Incomplete
combustion
未完全燃烧

内部挥发
Volatile



捕集装置 Capture system



存储装置 Storage device