PRODUCT DATASHEET

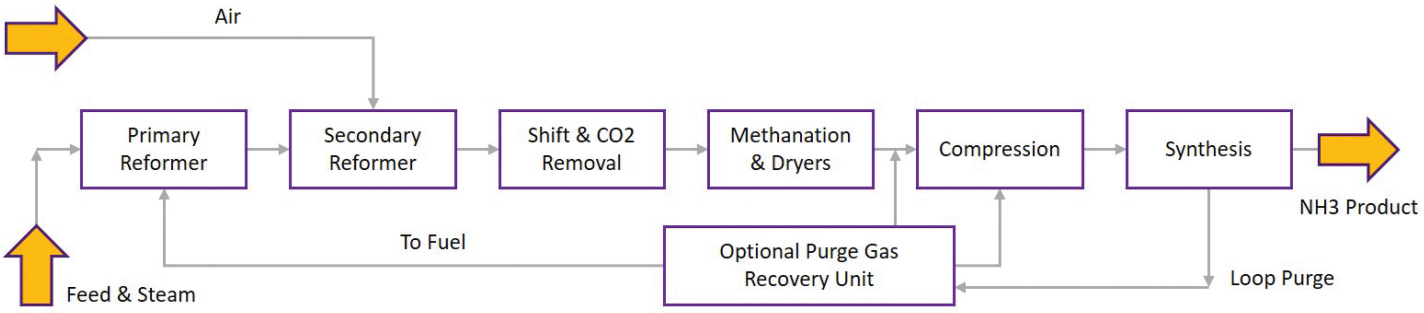
ROMeo Process Optimisation – Ammonia Reactor Models

ROMeo Process Optimisation - Ammonia Reactor Models provides you with the ability to simulate, monitor and optimise the reactor units, a key component of the ammonia process within ROMeo Process Optimisation. Tested and proven on industrial units, the reactor models accurately predict plant behavior in a wide range of operating conditions.

Enabling Ammonia Process Performance Optimisation

The ammonia reactor model portfolio is a major component of the AVEVA's reactor model family for ROMeo Process Optimisation. It contains models of the following reactors:

- Primary reformer
- Secondary reformer
- High temperature shift
- Low temperature shift
- Methanator
- Ammonia converter



Portfolio

Primary and Secondary Reformers

- Equilibrium reactor model for the steam-methane reforming and water-gas shift reactions
- Approach temperature calculated to indicate approach to equilibrium
- Steam to hydrocarbon and hydrogen to nitrogen ratios calculated
- Catalyst activity tuning to the adjust loading factor that affects the approach temperature

High and Low Temperature Shift Reactors

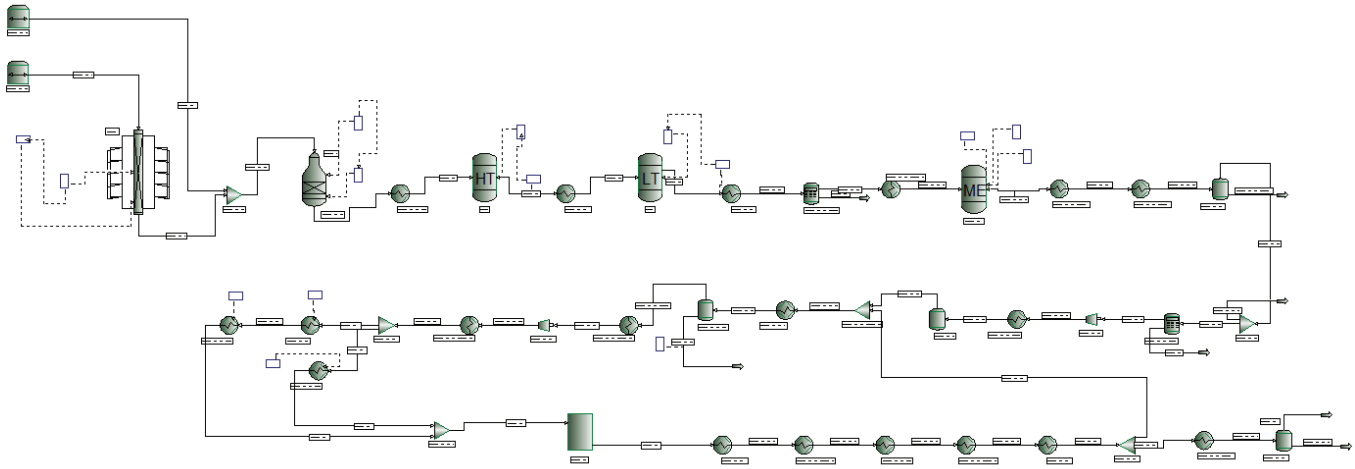
- Equilibrium reactor model for the steam-methane reforming and water-gas shift reactions
- Approach temperature calculated to indicate approach to equilibrium
- Catalyst activity tuning to the adjust loading factor that affects the approach temperature

Methanator

- Rigorous kinetic model for CO and CO_2 methanation
- Overall catalyst activity tuning parameter to adjust the residual CO and CO_2 amount

Ammonia Synthesis Reactor

- Rigorous kinetics-based model including both the forward and backward reactions
- Each bed can be configured as axial flow, radial flow or horizontal flow pattern to accommodate different types of reactors
- Overall activity tuning parameter to adjust NH3 yield
- Calculate composition and temperature profile along the bed, as well as approach temperature



Benefits

Real-time Optimisation

As the industry leader of real-time optimisation software, ROMeo Process Optimisation can access process data historian automatically, detect gross errors and reconcile the process data while simultaneously tuning the reactor model to match the plant. With built-in rigorous kinetics, the auto-tuned model is able to predict the reactor behavior in a wide range of operating conditions away from the current condition. With its nonlinear optimiser, ROMeo Process Optimisation is able to find the optimal operating conditions (setpoints) that maximize the benefit within operating constraints.

The new setpoints can be sent to AVEVA's Advanced Process Control to drive the unit to the optimal condition. With a portfolio that covers all major reactors in an ammonia process with different process and reactor designs, ROMeo Process Optimisation can optimise the whole process.

In a typical ammonia process, process and utility are fully integrated. ROMeo Process Optimisation offers both process and utility optimisation that provides the maximum economical benefit. Typical key optimisation points may include:

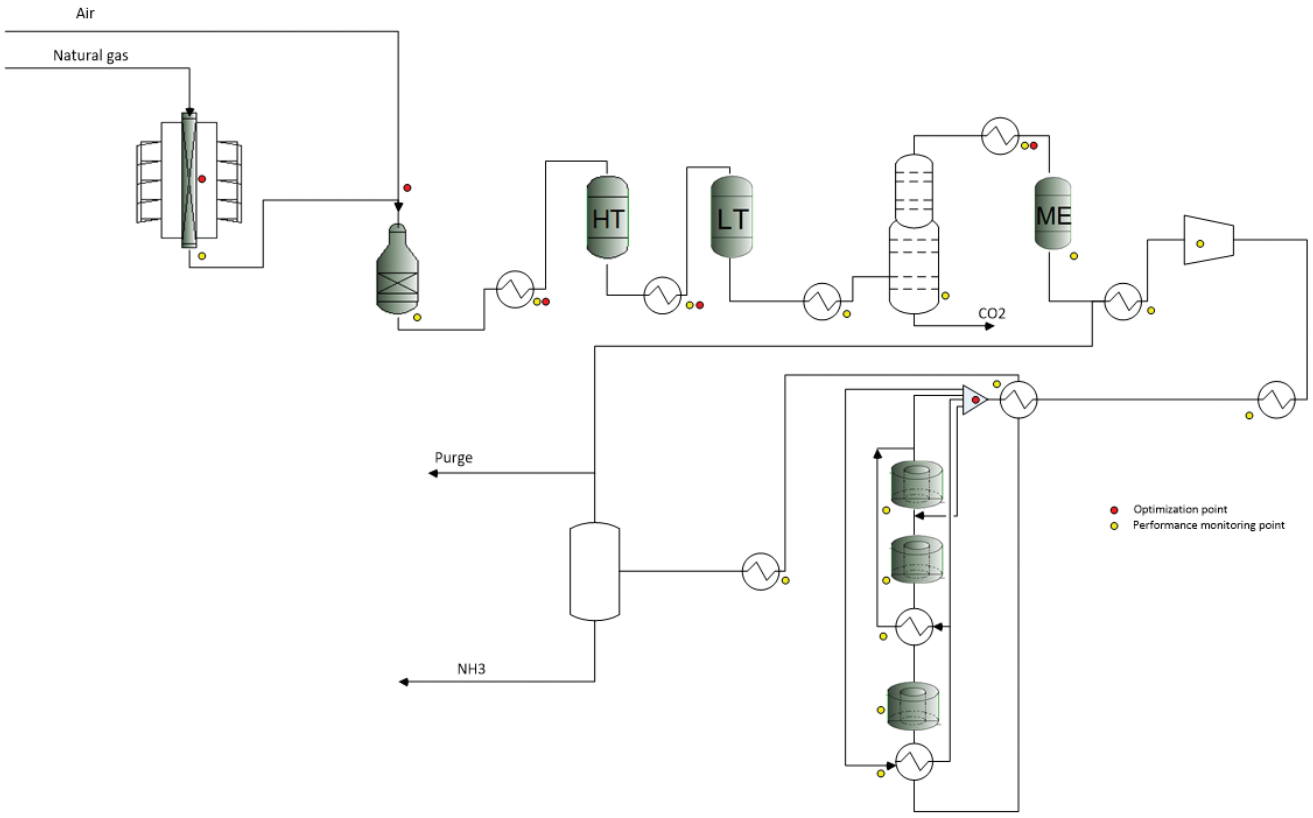
- Primary reformer: optimise steam to hydrocarbon ratio and outlet temperature
- Secondary reformer: hydrogen to nitrogen ratio
- High and Low temperature shift reactor: maximise conversion by adjusting inlet temperature
- Methanator: maximise conversion by adjusting inlet temperature
- Ammonia converter: optimise the inlet temperatures by adjusting the feed splits for maximum one-pass yield and reduced recycle
- Minimise purge rate while honoring inert constraints
- Steam, fuel and refrigeration system optimisation combined with process side for maximum total benefit
- Maximising throughput while honoring process and equipment constraints

Reactor and Catalyst Performance Monitoring

Reactor model auto-tuned by process data can accurately calculate catalyst activity and other reactor KPIs such as product yields and properties. The trend of these indicators, along with KPIs of other equipment such as heat exchanger fouling, pump and compressor efficiencies, and column tray efficiencies, can be used to evaluate the performance of the operation, equipment and catalyst to support business decisions.

Offline Process Engineering, Simulation and Case Study

Ammonia processes modeled with rigorous reactor models tuned by reconciled plant and lab measurement data provides process engineers with the best insight of the reactors' behavior. These models can be used for process simulation of different operating conditions, debottlenecking, what-if analysis and offline optimisation. With a provided easy-to-use Excel offline interface, offline process simulation has never been easier.



Advantages

- Full suite of reactor modeling technology for performance monitoring and optimisation of the whole ammonia unit
- Rigorous equilibrium and kinetics-based models allow accurate modeling over wider operating range
- Open equation-based modeling, enabling robust & broader scope modeling & optimisation