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Optimising Liquid Level Measurement In Urea Hydrolysis Reactors

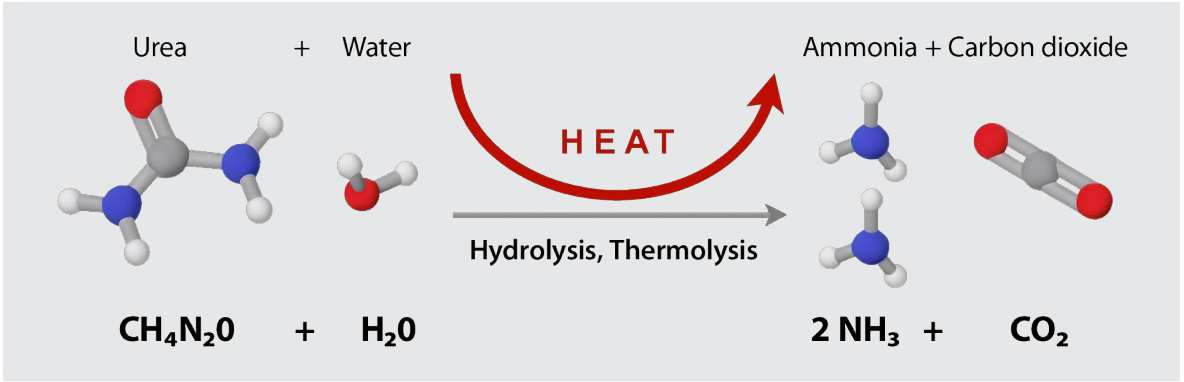
Overview

In response to national environmental compliance policies, power plants have shifted from using liquid ammonia to urea decomposition technology to generate ammonia for flue gas desulfurization. This transition enhances environmental safety while also reducing the storage and transportation risks linked to liquid ammonia. A critical challenge in this process is achieving accurate liquid level measurement within the urea solution hydrolysis reactor, where high-temperature hydrolysis converts urea into ammonia gas. Maintaining effective level control in this reactor is essential for optimizing ammonia production efficiency and minimising reagent consumption, thereby supporting both operational and environmental goals.

Challenge

A major power plant in China encountered significant difficulties in accurately measuring the liquid level within its urea solution hydrolysis reactor, due to the following factors:

- **Harsh Operating Conditions:** The reactor functions at temperatures of 130–160 °C and pressures of 0.4–0.6 MPa, presenting an extremely challenging environment for any measurement system.
- **Corrosive and Steamy Atmosphere:** The presence of ammonia, carbon dioxide, and water vapour contributes to corrosion, which can degrade sensor performance over time.
- **Critical Need for Stability:** Maintaining the liquid level below 70% is essential to preserve a buffer zone for hydrolysis gases, ensuring safe and stable operation of the reactor.
- **History of Sensor Failures:** Previous technologies – including non-contact radar and RF capacitance sensors – proved unreliable, with performance issues caused by steam interference and erratic readings.



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Application Background

Prior to implementing our solution, the power plant evaluated several alternative level measurement technologies, each of which presented specific challenges:

- **Non-Contact Radar Transmitters:** These devices suffered from significant steam interference, resulting in frequent and unreliable level readings.
- **RF Capacitance Transmitters:** These sensors were unable to cope with the reactor's high temperatures and were vulnerable to chemical ingress, leading to performance degradation.
- **Competitor Guided Wave Radar Systems:** Although similar technologies were available from other vendors, they failed to deliver the accuracy and reliability required for this demanding application.

ECLIPSE MODEL 706

Flagship transmitter that can take on applications from simple to severe

MAGNETROL LEVEL MATTERS

AMETEK LEVEL MEASUREMENT SOLUTIONS

Solution

To address the plant's measurement challenges, we implemented the Magnetrol Model 706 Guided Wave Radar (GWR) transmitter – a solution specifically suited for demanding process environments. Key reasons for selecting this technology included:

- **Exceptional Accuracy and Reliability:** The GWR transmitter delivers stable and precise level measurements, unaffected by steam or vapor interference.
- **Robust Construction for Harsh Conditions:** Built with 316/316L stainless steel probes and a ceramic-glass alloy seal, the device offers excellent resistance to high temperatures and corrosive media.
- **Low Maintenance Requirements:** The GWR system operates reliably with minimal upkeep, reducing downtime and lowering total cost of ownership.
- **Enhanced Process Efficiency:** Improved level measurement enables tighter control over urea feed and ammonia usage, minimizing waste and maximizing production efficiency.

Results & Benefits

Implementation of the Model 706 Guided Wave Radar delivered significant operational and environmental improvements:

Improved Process Stability – Precise level measurement enables consistent and efficient ammonia production, enhancing overall process control.

Reduced Operating Costs – Optimized urea and ammonia usage minimizes reagent waste and increases cost efficiency.

Lower Maintenance Requirements – The durable, reliable GWR system eliminates the need for frequent sensor replacements or recalibration.

Environmental Compliance – Accurate control helps maintain NOx emissions within regulatory limits, supporting environmental sustainability goals.

Business Impact

Operational Efficiency Gains – Decreased downtime and reduced troubleshooting lead to lower maintenance costs.

Optimized Chemical Usage – Improved measurement accuracy ensures efficient reagent consumption.

Regulatory Assurance – Stable performance supports reliable denitrification and long-term compliance with environmental regulations.

Conclusion

GWR delivered a reliable, long-term solution for the urea hydrolysis reactor, proving the value of choosing the right measurement technology. Improved level control led to greater efficiency, reduced costs, and enhanced compliance. Discover how our AMTEK LMS GWR solution can help you achieve similar results – contact us at Able to optimise your plant's performance today.

For more information, please contact Able Instruments on +44 (0)118 9311188 or by email: info@ableinstruments.com

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