

Confirming the Dew Point of Forming Gas using Intrinsically Safe Ceramic Moisture Sensors

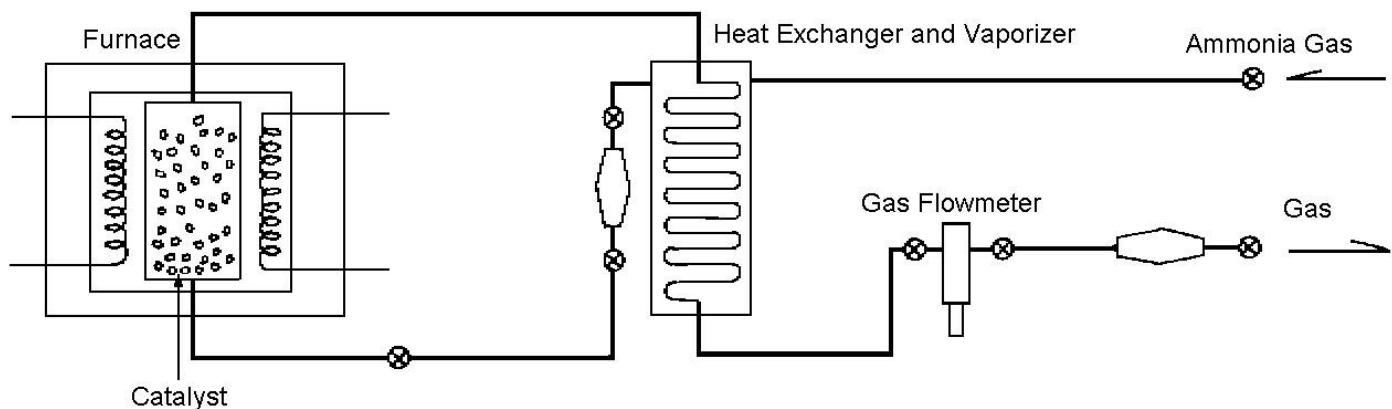
Application Background

Hydrogen gas is widely used for the bright hardening of many kinds of metals. There are two main delivery methods for this process - bulk hydrogen from storage cylinders and cracked ammonia. Both delivery methods have advantages and disadvantages - cost and fire hazard in the case of pure hydrogen and corrosion risk and human safety being the main considerations in the case of cracked ammonia. However, nowadays cracked ammonia plants are the more common method of providing a reducing/hardening atmosphere for metallurgical furnaces.

What is the process in an ammonia cracker?

Pressurised liquid ammonia is heated in order to vaporise it and is then passed over a nickel catalyst at a temperature of around 1000°C, which causes it to dissociate into its component parts - hydrogen and nitrogen. The chemical equation for this reaction is: $2\text{NH}_3 \longrightarrow \text{N}_2 + 3\text{H}_2$

The diagram below illustrates the cracking process:



As a result of complete dissociation into hydrogen and nitrogen, very little undissociated ammonia remains and the dew-point temperature of the resulting gas should be very low (well below -30°C). This gas can also be dried further by use of a heated-regeneration twin column desiccant dryer, the molecular sieve will also adsorb traces of uncracked ammonia still present in the gas, the gas exits the system dryer than -65°Cdp, consisting of 75 Vol% hydrogen and 25 Vol% nitrogen.

Applications for dissociated ammonia

The forming gas is used in conveyor furnaces and in tube furnaces for annealing processes in a reducing atmosphere, such as brazing, sintering, de-oxidation, and nitridation.

Dew-point measurement in cracked ammonia

As long as the forming gas is free from trace ammonia, any Michell impedance type hygrometer may be used for either on-line or spot check measurement. Michell's low-cost Easidew range (transmitter, on-line hygrometer and portable hygrometer) are suitable for measurements in locations with no hazardous area classification. This is common in many furnace applications. If a measurement location is declared as hazardous under an ATEX directive, Michell offers its premium hygrometer range, comprising Easidew Pro IS Dew-point Transmitter, or the Cermax IS hygrometer - a portable intrinsically safe dewpointmeter.

All the above instruments are fully factory calibrated with traceability to UK and International standards and offer high accuracy, long term reliability and ruggedness, backed up by a first class after sales service that includes the option for extended maintenance agreements and exchange sensor services.

Note: Other similar applications include the process for tin galvanising of steel sheets where endothermic gas is often used to blanket the furnace to prevent surface oxidation. There is also a requirement to measure the dew point in a Nocolok furnace, used for controlled atmosphere brazing (CAB) in the production of heat exchangers. Both of these applications can use any of the above sensors, dependant on the ATEX specifications.



Reference Users

British Steel, IMCI Italy, Orb Electrical Steels, UES Steel



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