Using Ceramic Moisture Sensors to optimise the Ozone generation process

Application Background

Ozone (O_3) is increasingly used to purify water as an alternative to chlorination. There are four principle applications:

- Production of potable water (drinking water)
- Sterilization of feed water for food and pharmaceutical production
- Sterilization of swimming pools
- Sterilization of waste water after treatment and before release into the water cycle

Historically, chlorination has been the preferred large scale method of sterilization of water. However there are significant health and safety risks involved in the bulk transport and application of chlorination systems; cost is high and there are significant environmental implications through the release of chlorine into the water cycle. Also chlorine can produce harmful, carcinogenic chlorohydrocarbons as a by-product.

For these reasons the implementation of ozone sterilizers has gathered pace in recent years. Both chlorination and ozonation have the same basic effect. Both are extremely powerful oxidising agents, which attack the impurities (specifically microbiological agents) in the water and break them down into harmless residues that can be filtered out of the water system. The advantage of ozone is that after it has reacted with the microbes it breaks down to oxygen, which is totally harmless.

Why is Moisture Critical?

There are three main reasons to measure the moisture content of the feed air or oxygen in this process.

- Prevent arcing in the generator electrodes
- Prevent corrosion of system components due to nitric acid formation
- Increase ozonation efficiency

Typical Industrial Ozone Generation System

If a high moisture level exists in the feed gas, arcing of the electrodes and in extreme cases contact breakover to chamber walls, will occur. This arcing will damage the electrodes and the system walls and eventually lead to failure and expensive repair.

A by-product of arcing in the presence of ozone, nitrogen and water will be nitric acid and other nitrous compounds, which will cause corrosion of electrodes and system components, again leading to eventual failure of the ozone generator.

The efficiency of the ozone generator is inversely proportional to the moisture content of the feed gas. If the moisture content is reduced from 50 ppm to 5 ppm (from about -50 to -70 °C dew point), the generator efficiency can be increased by more than 20 %.

A normal minimum specification for the air or nitrogen feed is -50 °C dew point, but if this can be reduced by correct dryer control to -70 °C dew point the operating efficiency and lifetime of the plant can be improved significantly.

Measurement Technique

An impedance hygrometer from Michell can be used to monitor the moisture content of the feed gas either on-line (Easidew Transmitter, Easidew On-line or Cermet II) or on a spot-check basis (Easidew Portable or MDM300). In conjunction with a dryer control system, an on-line hygrometer can be used to ensure that the feed gas is as dry as possible, maintaining generator efficiency and lifetime.

WARNING: Due to the extreme oxidising power of ozone, the hygrometer sensor should not be used to measure the dew point of the end product. This, anyway, is not the critical factor as the ozone will be bubbled into the water to be purified!

MDM300

Reference Users

Ozonia, Waterwise Technology, Proctor & Gamble, numerous regional water treatment companies including Seven Trent and Southwest Water

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