

# New approach to acid mist elimination

Proper selection of internals for mist elimination in sulphuric acid drying and absorption towers is still a challenge as regards performance and materials of construction. In sulphuric acid drying towers, knitted wire mesh pads are the principal type of equipment used. Poorly designed, corroded or fouled drying tower mist eliminators are common sources of excessive entrainment. In drying towers the operating life of mist eliminators is affected by two primary factors: corrosion and fouling. A new PTFE filament used in the Sulzer KnitMesh XCOAT mist eliminator provides an innovative approach to these problems.

**P**roper selection of equipment for mist elimination in sulphuric acid drying and absorption towers is still a challenge from the performance and material points of view. Operating evidence shows that the gas-liquid interface represents one of the highest risks of corrosion and since mist eliminators operate in this region, they are one of the most challenging corrosion environments in the plant. In sulphuric acid drying towers, knitted wire mesh pads are the principal type of equipment used. One of the common sources of excessive entrainment are corroded and fouled mist eliminators used in drying towers which causes acid condensation during shut-downs and thus degradation of the catalyst. Several factors have therefore to be considered in the selection of the mist eliminator type and the material of construction where the longevity depends on the operating conditions, acid concentration and used material.

## Acid mist eliminators

Knitted wire mesh mist eliminators are used as a low cost, highly versatile and efficient method of removing liquid entrainment from gas streams. They are produced as a bed of knitted mesh which presents a tortuous path and large surface area to the droplets entrained in the gas stream. Separation is achieved by impingement and capturing by the filaments of the mesh where droplets coalesce and drain. High performance mesh mist eliminators provide excellent separa-

tion efficiency down to droplet sizes as small as 2 microns and with a pressure drop typically less than 7 mbar.

## Impact on lifetime due to corrosion

Most common drying tower mist eliminators comprise of stainless steel wires which have a standard diameter of 0.28 mm. Even with low corrosion rates, it will not take long for the wires to corrode through. Assuming a corrosion rate of 0.1 mm/year the wire will be destroyed in two years or less.

In common cases nickel based alloys such as Alloy 20 can be used to reduce the rate of corrosion and to improve the service life of the mist eliminators. However, there are cases where even Alloy 20 does not resist because the temperature and/or sulphuric acid concentration ends into a range where increased corrosion occurs. Drying tower mist eliminators face dangers from such swings in the acid concentration and temperature. Both of these factors can result in a significant decrease of service life.

Silicon containing stainless steels provide an improved corrosion resistance towards sulphuric acid. But, depending on the alloy type, operating temperature and acid concentration, the corrosion rate can rapidly achieve a critical level for mist eliminator wires where only 0.05 mm of corrosion allowance exists. In addition, the presence of fluorides should be avoided since it will attack the silicon in the alloy.

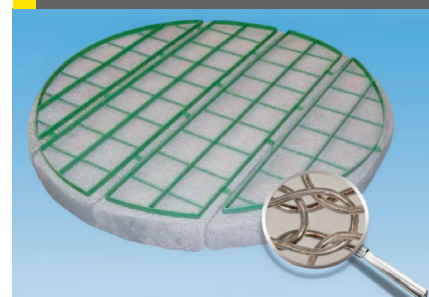
Non-metallic materials such as fluoroplastics like PTFE, PFA, ETFE or FEP also

are known to be very resistant to corrosion. However, they lack mechanical strength and are prone to shrinkage at higher temperatures causing gaps between the sections and gas bypassing. Amongst these materials, PTFE shows the best results in resistivity and durability at high temperatures and it's totally resistant to sulphuric acid.

## Sulzer KnitMesh XCOAT mist eliminator

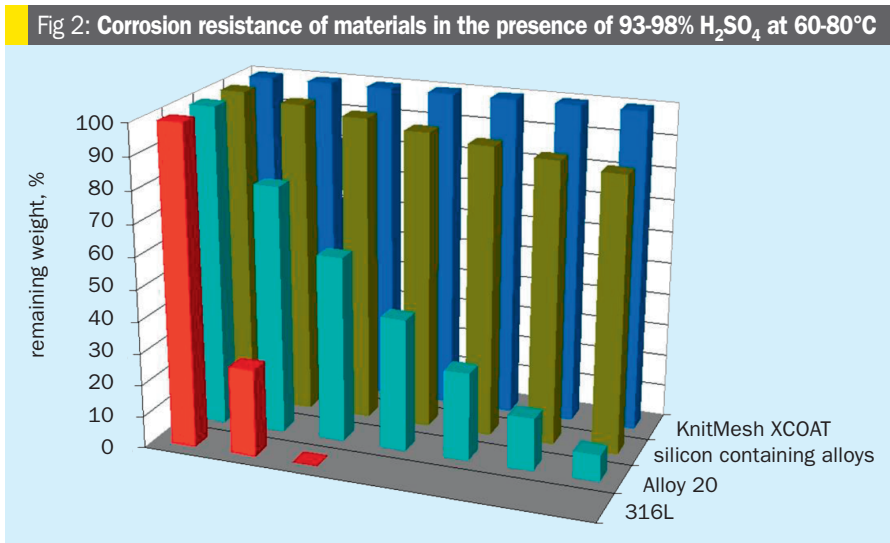
To address these concerns, Sulzer has introduced an ideal mist elimination solution for corrosive media. The concerns related to corrosion, shrinkage, collapsing is now solved by the new Sulzer KnitMesh XCOAT mist eliminator (Fig.1) which combines the excellent chemical and temperature resistance of PTFE with the mechanical strength of a stainless steel wire. The Sulzer XCOAT material consists of a 100% pure PTFE monofilament which contains a stainless steel wire as a

Fig 1: Sulzer KnitMesh XCOAT mist eliminator



core. This leads to an extremely high resistance to deformation, corrosion and temperature, and makes it highly ideal for corrosive environments such as sulphuric and acetic acid applications. Characterised by these features, the Sulzer KnitMesh XCOAT is the world's first patented wire mesh mist eliminator being a PTFE 'monofilament' and integrating all the valued advantages of metal wire mesh pads.

Field and lab tests have been conducted to demonstrate the corrosion resistance of the Sulzer KnitMesh XCOAT. Figure 2 compares the corrosion between the Sulzer XCOAT and various stainless steel and alloy wires in the presence of 93-98% sulphuric acid, at 60-80°C over the period of one year.



**Table 1: Pros and cons of wire mesh mist eliminators made of different materials**

	Stainless Steel	Alloys	Synthetic fibres of fluoroplastics	Sulzer KnitMesh XCOAT™ mist eliminator
Corrosion resistance	XX	X✓	✓	✓✓
Separation efficiency	✓	✓	✓	✓✓
Temperature resistance	✓	✓	XX	✓
CAPEX plus OPEX	X	X✓	XX	✓