

What is



Ammonia Stress Corrosion Cracking

Ammonia Stress Corrosion Cracking (SCC) is the phenomena of cracks being formed in carbon steel in contact with ammonia. The cracks are small at the surface but can be deep, worst-case going through the entire thickness of the metal. See photo below.

What is



the problem with SCC

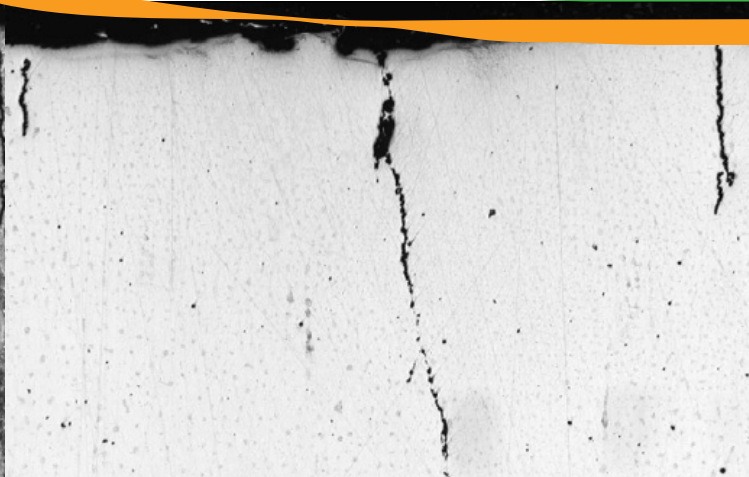
SCC can threaten the integrity of the ammonia containment equipment. Stress Corrosion Cracking has been detected in ammonia storage tanks, spheres and other process equipment that is in contact with liquid ammonia. It can happen at atmospheric liquid ammonia conditions at -33 °C, but also at higher temperatures under pressurized ammonia conditions. Also tanks for transporting liquid ammonia, like rail tank cars, tank cars, barges and vessels can be susceptible to stress corrosion cracking. It is difficult to repair SCC damage. Often complete replacement of the equipment (like a new tank) is necessary when SCC is found.

What is



the root cause for this SCC

The presence of oxygen (air) and residual stress are the causes for forming SCC cracks. Therefore the ingress of air into ammonia containing equipment must be prevented. This is a shared responsibility of the ammonia producing and consuming industries. Through the transport of ammonia via rail tank cars, barges or vessels, oxygen can be transported from one location to the other. Also the return of empty transport tanks can be a source of oxygen.



How



can we prevent SCC

1 Make sure not to have oxygen (air) present. Typical sources of oxygen are hoses, (un)loading pipe work, process equipment that has been open (after a turnaround or an inspection), vacuum conditions. One should apply nitrogen purging systems to prevent air getting into the ammonia system, and only when all air is out one should take in operation ammonia equipment that has been opened. And also be sure that your supplier or customer is not “polluting the ammonia transportation chain” with oxygen. Regular system analysis on the oxygen content can assure the absence of oxygen.

or

2 Add at least 0.2 % water to the ammonia. Water prevents the formation of SCC cracks. This measure does not mean that one should not try to still minimise oxygen ingress.

or

3 Apply stainless steel equipment. Stainless steel is not susceptible to SCC. But be aware that when you operate using stainless steel equipment with high oxygen levels, you may pass the problem on to others in the ammonia chain. When carbon steel is used, post weld heat treatment must be performed to reduce residual stresses. Weld hardness should not exceed 225 HV.



Avenue E. van Nieuwenhuyse 4/6
B-1160, Brussels, Belgium

Tel: +32 2 675 3550

Fax: +32 2 675 3961

antoine@fertilizerseurope.com

www.productstewardship.eu
www.fertilizerseurope.com

 twitter.com/FertilizersEuro

 www.youtube.com/fertilizerseurope

Ammonia

Stress

Corrosion

Cracking