Preventing loss with insulating coatings

A common, and unfortunate, theme of storage tanks around the world today is loss. Whether it is vapour loss, energy loss, or even loss of substrate due to corrosion, any of them can be costly. Most facilities have to contend with at least two of these, but sometimes they have to deal with all of them. Many solutions have been found to combat these issues individually, but there is only one solution out there that can help tackle all three: insulation coatings.

Thermal insulating (or insulation) coatings came onto the market in the mid-1990s and were mainly used in commercial and industrial applications. These are not reflective rooftop coatings or radiant barriers, which solely reflect UV rays due to their bright white colour. Thermal insulating coatings are usually acrylic resins filled with insulating particles, creating a true thermal barrier between two environments. The market was slow to accept them, as it was hard to believe that a coating thickness of 1-5mm could effectively insulate and replace inches of conventional insulation.

Today, there are countless applications for personnel protection, energy retention, reduction of radiant heat gain, prevention of corrosion under insulation (CUI), and condensation reduction. The coatings are specified as replacements for certain types of conventional insulation worldwide, with clients such as Shell, Chevron, Exxon, and BP facilities.

Vapour

But back to the three types of loss mentioned above and how insulating coatings can help facilities combat them. First of all, vapour loss is a huge problem worldwide, not only because of lost product, but also damage to the surrounding environment. It can occur in a few different ways, such as the loading of tanks and trailers, and when heat energy from the ambient environment enters a tank. The amount of vapour loss that can occur depends on a wide variety of factors, including product being stored, product volume, tank volume, type of tank roof, and the external temperature and weather.

Some facilities have floating tank roofs, which are very successful at eliminating breathing losses. Not all facilities have these roofs installed, as they are expensive to construct and maintain. In those facilities, the company has very little choice on how to combat heat gain on the roof, which most of the time must be accessible to personnel. In those instances, a thermal insulating coating would be an ideal solution.

The coatings work well to combat vapour loss in a few ways. Firstly, they can be walked on without fear of damage to the coating or its performance. Conventional insulation cannot be walked on, as either the jacketing or the insulation, or both, will be irreparably harmed. Secondly, they are fairly inexpensive to install, as the geometry of every roof is different. Between 0.75 and 1mm, which usually all that is required to retard radiant heat gain, can be

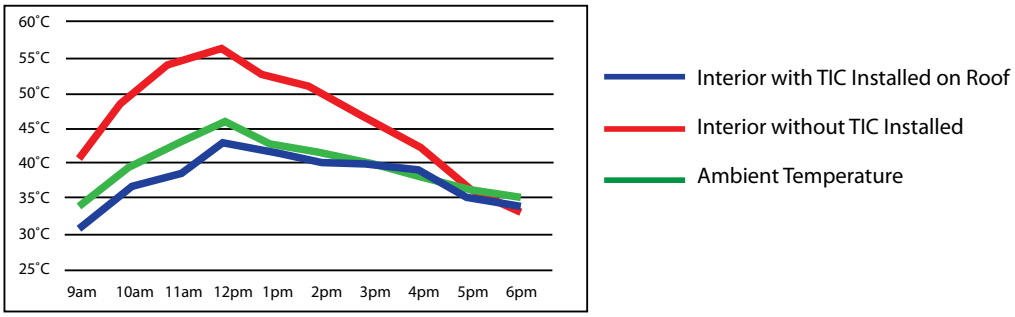

Figure 1: Temperatures recorded on two matching vessels, one coated with a TIC and one without. Radiant heat gain is a leading source of vapour loss in storage tanks

installed in as little as one or two days by a crew of four to six people. And unlike reflective coatings, which have been employed in the battle against vapour loss, the coatings work well clean or dirty. They do not solely rely on the coating's reflective properties to achieve an extremely effective insulating barrier.

As Figure 1 shows, the ambient temperature increases throughout the day – the 'oven effect' of having the sun continually raise internal temperatures of a closed system is effectively negated. This trial was run on two units on the same day.

TICs are able to be applied quickly by as few as two to four workers on large areas, and allow foot traffic after installation

Energy

In much the same way that insulating coatings effectively keep heat out, they are also effective at combatting energy loss by keeping heat in where there is an internal heat source. Energy retention is a major issue in today's world, not only because of cost, but also because of environmental stewardship. Unlike conventional insulation, which stores heat to act as a 'thermal battery', thermal insulation coatings (TICs) actively reflect heat back into the system. This means that there is less time at start-up for the insulation to begin working efficiently.

For example, at an asphalt facility in Florida in 2007, the company had conventionally insulated the sidewalls, but was not able to insulate the roof due to foot traffic. After realising that it had to run two heaters 24/7 to keep the asphalt at the desired temperature, the company knew it had to do something to keep the heat escaping the roof and so contacted an insulating coatings manufacturer to talk about the possibly of the coating being able to help with the issue.

Because the asphalt company wanted to greatly reduce its energy usage, it was recommended to apply 5mm of the coating. That is on the very high end of application thickness because insulating coatings are more energy efficient the thicker they are applied. After application, the surface temperatures of the tank top and rim were reduced and the product was found to be more stable with less heat introduced into the system. In fact, the company was able to heat the entire tank with only one heater running and even that could be switched off over the weekend.

Another problem that conventional insulation has when it comes to energy retention is that its effectiveness is severely reduced when moisture is introduced into the system. So when an engineer specifies an insulation that is not hydrophobic based on its R-Value, that R-Value is immediately reduced when moisture is present. In many humid areas this is almost immediately after installation.

It does not take jacketing too long to become damaged and allow water inside the system. Insulating coatings are not susceptible to moisture intrusion (unless ponding water is present), so moisture does not affect the coatings' ability to keep energy within the system. This moisture can also lead to the third way an insulating coating can save a facility a great deal of time, money and headaches – CUI prevention.

Corrosion

CUI is a plague that almost every facility around the world has to contend with. Once moisture is introduced between insulation and a substrate, not only is the insulation ability degraded, the substrate is immediately susceptible to corrosion. The loss of this substrate integrity can lead to accidents, unnecessary maintenance, worker safety issues, and costly turnarounds. Most conventional insulation systems require a sacrificial primer that will work for a time, but will eventually degrade and need to be replaced. To do that, the entire insulation system must be torn apart and replaced every few years, a costly cycle that many facilities endure year after year.

Insulation coatings require a primer on carbon steel, but that is only because the coatings are water-based and can cause the steel to flash rust. Once the coating is cured and all water has been evacuated, the coating prevents moisture from being trapped between itself and the surface. In fact, insulation coatings have no special ingredient to combat corrosion. They work by completely enclosing the system and not allowing for water intrusion.

Once the coating is applied to the primer or bare substrate, moisture has no way to enter the system; therefore CUI is not an issue. It is actually a simple solution to a complex problem that storage tank facilities have been dealing with for years. In fact, there is one worldwide petrochemical refiner that takes equipment coated with an insulating coating out of its CUI programme entirely, because it has seen first-hand how CUI is not an issue after the application of a coating.

Problem-free

Insulating coatings are not a miracle product that can solve all the issues that insulation faces in industrial environments, but it does a great job in a niche area, namely equipment below 190˚C. When equipment is below that temperature, there is a good chance that the coatings can help not only with the three issues above, but also things like personnel protection and condensation reduction.

The growing acceptance of the coatings has made many end users more knowledgeable and confident knowing that they do not have some of the problems that are so prevalent in storage tank facilities today.

For more information:
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