Argon Gas as Insulator
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In March, 2010, during a flood rescue in West Virginia, a firefighter was killed when his boat was overturned and he was thrown into the frigid water. Two other men were also thrown into the water, but they survived. These three individuals in the same situation had vastly different outcomes. What made the difference according to the National Institute for Occupational Safety and Health? Insulation.

It's not every day you can thank your coat for saving your life. But when it comes down to it, a smart PPE choice can be the difference between life and death.

History of Insulation:

For thousands of years, when humans needed protection against extremely cold temperatures, they would clothe themselves in pelt. This worked fairly well, save for the smell and, as we progressed as a culture, the risk of getting paint thrown on their fur by someone from PETA. Over the ages, humans continued to look to animals for new ways to stay warm. Wool was a good source as was down – but the result was either scratchy or so expensive that only the very wealthy could enjoy it.

We advanced even more and started to create down-like materials – from which beautiful puffy coats were born – stylish, yes, but not very useful for an active lifestyle.

Through the evolution of insulation, we came to realize that it is really the pockets of air that are warmed by our body heat that keep us the warmest. Which brings us to the next generation of insulation: argon gas.

What is Argon?

Argon was initially discovered by English scientists when they realized that there was something other than nitrogen, oxygen, carbon dioxide, and water in the air. Lord Rayleigh and Sir William Ramsay were finally able to isolate this mysterious substance in 1894 – discovering the first noble gas which they named "argon" (Greek for "lazy" or "slow") in reference to its inactivity.

It is a naturally occurring gas that makes up 0.934% of the earth's atmosphere by volume. It is heavier than air with a density of 1.784 grams per liter compared to the density of air of 1.29 grams/liter. It is non- flammable and will not burn or explode as a gas.

Safety of Argon

Argon is colorless, odorless, and tasteless and since it occurs naturally in the atmosphere, it is not a threat to the environment. No threshold limit value, permissible exposure limit, or maximum acceptable level has been established for normal exposure to argon gas. It is also noncorrosive. As with any inert gas, however, releasing in confined spaces should be minimized since these types of gasses can displace oxygen resulting in light headedness. When encapsulated (in a jacket or another casing), this already small risk is mitigated.

Uses of Argon

Argon is commonly used as a "shielding gas" in arc welding; in incandescent light bulbs to help the wire filament burn longer and brighter; and in "neon" signs. Argon is also employed in medical lasers to treat skin conditions. An argon-dye laser is used for eye surgeries for certain retina conditions or to heal damaged blood vessels. Most commonly, however, argon is used as insulation between double paned windows due to its lower thermal conductivity which helps it trap heat.

People began using argon for dry dive suits after it was determined that using argon versus air increased the total suit insulation by 20 percent – a critical difference when you are diving hundreds of feet under water or participating in ice dives.

Argon Compared to Other Insulators: A little goes a long way.

Argon, downs (natural and synthetic), as well as other synthetic insulating materials all work by trapping body heat.

For down and synthetic down, the insulating properties are directly impacted by the quality of the material used and the thickness of the insulating material. Down allows body moisture to evaporate, retains its shape for a period of time, and is lightweight – although the fabric containing it can be heavy. Synthetic down is less expensive, holds its insulating properties when wet, is easier to care for than down, and is hypoallergenic. Some of the "down" sides: Down loses its insulating properties when wet; it can be expensive to care for down-filled garments; some people are allergic to down; and the higher quality products are expensive. Synthetic down breaks apart over time; is heavier than down; and tends to be bulkier than down.

Say goodbye to heavy PPE. Argon gas, on the other hand, is dense, but weightless, so it insulates up to three times better than natural or synthetic fibers, and without the bulk. Workers don't need a lot of it to keep warm (when compared to other insulators), so productivity can be sustained. It also retains its shape and will not lose loft over time. Additionally, argon serves as a wind- and water-breaker, a significant advantage.

Argon's thermal conductivity – the rate you lose heat through a material – is 0.016. Down has a thermal conductivity of 0.025 and some of the more recent synthetic materials have thermal conductivity ratings of 0.03478 – more than double the rate of argon. Meaning, there is greater heat loss with down and synthetic materials than there is with argon – making argon the better insulator.

Summary

Staying warm under a variety of conditions has long been a challenge of the human race and having the right insulator for conditions is critical to survival. Argon is a naturally occurring gas that has excellent, inherent insulating properties. It has long been recognized as an insulator in windows as well as in the extreme environment of diving. As an on the job insulator, it is flexible, ultra lightweight, adaptable to a variety of insulating scenarios – and environmentally safe.

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