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The use of nitrogen as a fluid carrier in the spray painting industry and in other similar applications:

In the manufacturing industry inert gases are widely used for storing, conveying and spraying paint.

However, the advantages of nitrogen over argon, whose use is not cost effective, are its low density and its low fusion and boiling temperatures making it the ideal fluid carrier.

Nitrogen is often used in the spray painting industry to seal polyurethane based paints (isocyanic prepolymers in particular) which react when exposed to the humidity present in the air we breathe, since vacuum sealing can not guarantee the complete elimination of water molecules. This has proved to double its shelf life.

The cost of obtaining nitrogen gas from its liquid state, though, offers no real economic advantage. DERIVAIR, instead, has come up with a new method (recently patented) for generating nitrogen through a process of selective permeation (PSA) that is much more competitive.

Using nitrogen as a propellant in spray painting systems - a method and an application technique covered by an international patent owned by EUROSIDER - has produced outstanding results.

To date two spray painting techniques (excluding powder coating technology) have been adopted:

1. Airless or rather the indirect use of air as a fluid carrier with equipment that includes a special membrane pumping unit;
2. compressed air and a spray gun, where air itself is the propellant for the paint.

The first is based on Pascal's principle, where the size of the membrane pumping unit Determines the amount of increase in pressure; that is to say, from a starting point of 8 bars The pressure, according to the capacity of the membrane, can be increased to up to 200 Bar and more.

This technology is often used in industry in the application of solvent less or solvent free Paint in a single coat (up to 2mm) where the paint is highly viscous. These Types of paint, however, can not be used with spray guns or spray painting systems which require the paint to be applied in much thinner coats.

In the body shop spray painting and woodworking sectors it is common practice to use Paints with a high organic or inorganic solvent content (10% - 50%) with

finished coats from just a few microns up to 200-300 microns, after which solvent free paint or paint with a high solvent content is applied.

In this case, however, the air even when it is dehumidified, dried and heated contains impurities and has the potential to become charged with static electricity, which can be transferred to the surface being sprayed with a finished result that is less than satisfactory.

Moreover, with certain paints the presence of foreign bodies can even cause a chemical reaction which alters the properties of the paint and its drying time.

Nitrogen, on the other hand, because it is anhydrous, removes humidity from the surface being sprayed and because it has a low specific weight does not alter the outlet flow pressure of the spray gun.

Furthermore, by heating the nitrogen to a temperature of 50°C and above, the paint becomes more fluid reducing the need for solvents and in turn allowing for a reduction of the outlet pressure, which means there is also a significant reduction in the overspray effect.

Since nitrogen also has an extremely low dew point, it not only eliminates the problem of humidity but also the age-old problem of blistering.

This new method classifies as 'surface tolerant', a term which indicates a type of paint that can be applied to surfaces where humidity is present (pressure pipes for example).

By first spraying the surface being treated with heated nitrogen, application times are shortened and there is a considerable reduction in the amount of contaminants released into the air, anticipating future standards regulations for emissions.

In the case of wood and concrete which are more porous, application times are reduced even further.

Of course certain paint products need to be slightly reformulated in order to obtain the best results using a system such as that proposed by EUROSIDER, but this is a minor consideration, since with the experience and know how acquired, it is just a matter of simplifying the formulation itself.

There are in existence spray painting systems which use so-called reactive coatings that harden in 5 to 6 seconds, where the surface being sprayed has to be completely free of humidity. Such systems use various methods – hydralics for the primary pump and compressed air for the secondary pump.

The use of nitrogen eliminates all the problems associated with the formation of mositure during expansion, such as the malfunction of the main pumping unit and the resulting imbalance of the system in general.

One of the most interesting characteristics of this new method is that it can charge the nitrogen (using a sophisticated, patented system) with static electricity. Since nitrogen has no polarity, this can be selected to prevent possible inverse polarity being generated in the paint and therefore on the surface being sprayed.

The ionization energy of an atom or a molecule is the minimum energy required to remove an electron from the ground state of the isolated gaseous atom. Hence, the energy necessary to make the following process happen:
X(g)®X+(g)+e-I1

By minimum energy required we mean, if not otherwise specified, the process by which the action (a positively-charged ion with fewer electrons than protons) finds itself in its ground state. In other words, the ionization energy is the energy difference between the species X+(g) and X(g).
The ionization energy is sometimes represented as EI1, but more commonly as I1, used to indicate that they refer to the first ionization energy.
In a similar way the following can be defined:
X+(g)®X2+(g)+e-I2
X2+(g)®X3+(g)+e-I3
Etc.

As can be seen, the more an action is positively charged the more difficult it is to remove a further electron, hence I1<<I2<<I3 and so on. For atoms the number of ionization energies is equal to that of their electrons and therefore to their atomic number. Molecules, instead, tend to dissociate if deprived of electrons and therefore generally it is not possible to go beyond the first or sometimes the second ionization energy.

The unit of measure used to express these is almost always the electron-volt, eV, occasionally kJ/mol. The ionization both of an atom and of a molecule is an endothermic process and therefore the ionization energies are always positive.

This means rebounding particles are eliminated and the overspray effect is reduced significantly with advantages in the maintenance of spray booths and spray gun nozzles, a more economical use of paint products, increased production and considerable savings.