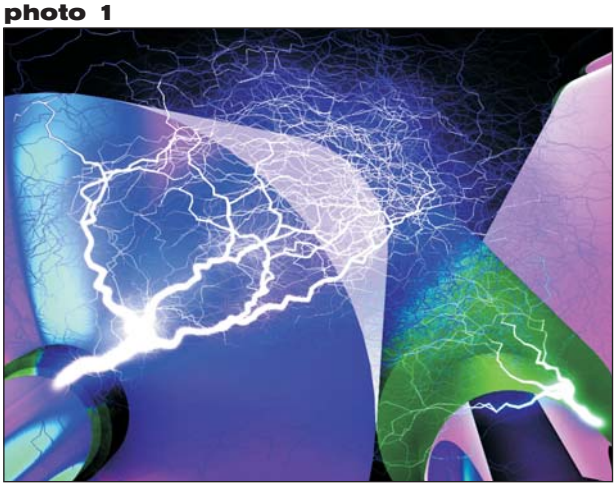
HAUG Ionization – Avoiding dangerous sparks

A small electrical shock from gripping a door handle or hair standing on end after combing are just two examples of how we are surrounded by electrical charge everywhere. Although this is normally quite harmless in day to day life, it constitutes a real challenge in industrial production. The author takes a look at new interesting processes to properly control electrical charge.

Although electrostatics is often referred to as a stationary or "static" electrical charge on surfaces, during winding operations these very charges could cause serious problems because, if electrostatic charge is unwound or rewound layer after layer, an electrical capacitor could be created.

photo 1



Electrostatic dangers

Electrostatic charge tends to increase or build up continuously during any mechanical process. The consequences are well-known massive spark discharges with serious consequences for men and material.

A spark quivering over release layers can produce similar results to a corone treater, affecting the release characteristics at these positions. As a result the web may even break along its length. Also, uniform coating may be affected by discharging sparks. In the worst case sparks might even destroy a complete roll.

Moreover, electrical charge works like a dust magnet.
A charged roll will attract even the finest dust particles from its surroundings. In pharmaceutical an food applications this causes hygiene problems.

The phenomenon becomes especially unpleasant, even dangerous, in industrial environments if a worker unintentionally becomes a lightning conductor or gets a shock from coming too close to moving machine parts.

Reasons and parameters

When unwinding and rewinding non-conductible materials such as plastic film or coated paper electrostatics can cause almost unmanageable problems. The degree of charging depends on parameters that, although well defined, are difficult to control.

On prime reason for electrical charging is material composition. Highly isolating materials which contain no so-called antistatic additives are particularly dangerous, especially film for food packaging and coated paper that cannot discharge properly. Even the prevailing air humidity in the winding operation area influences whether or not a dangerous electrical charge is formed. High humidity helps to condition the material surface. Film and coated substrates may develop an ultra thin moisture layer on the surface, whereas paper fibres literally soak up humidity from the air. The static that is building up the whole time can be discharged slowly through the moisture of the substrate or simply the air humidity.

Higher speeds

Machine speeds must be maintained to meet production demand but the level of static charge increases with substrate and machine speeds. If the web has been subjected to corona treatment before rewinding the problem of charging the roll is increased further.

During such a process the material is bombarded with electrical charge. As a result, strong spark discharge can be observed not only on the material roll but also on almost every single deflection roller. Even web tension influences the amount of charge developed on the material surface. The higher the tension, the tighter the contact is to the surface of the rollers and, consequently, charge increases.

It goes without saying the the rubber rollers cause much higher charging than electrically conductive rollers with a metal surface. Whereas electric charge can disperse on a metal surface, rubber will even charge itself and then transfer this static to the web substrate.

As soon as the substrate touches a rubber roller, every prior attempt at discharging is inevitably cancelled out. Due to the contact with the rubber the web surface is constantly being recharged. Also such measures like ionization rods, dischargers or anti-static rods, which have been installed in order to eliminate electric charge, do not offer a viable solution. This because as soon as material touches the deflection and nip rollers a new charge is created which subsequently ends up on the rewound material, although it is not a problem to remove static on the web material.

Discharging the material roll

In order to effectively remove static from the roll material and in order to avoid development of critical electrical charge, efforts at discharging should also be concentrated on the rolls and not just on the web itself.

The appropriate equipment, comprising ionization rods, dischargers, and anti-static rods are also called active ionizers. They can create and spread charge carriers (ions) which make themselves available for an electron exchange with the electrically charged materials on the surface, leading to de-facto electrical neutralisation.

As the distance between the ionizing equipment and the charged material increases, the amount of available ions decreases due to the elctron exchange between the positive and negative ions.

Consequently, an active ionizer should be positioned close to the roll surface and mechanically tracked according to movements of the roll. Depending on the type and the design, the distance must be between 20 and 150 mm. However this can turn out to be a rather demanding job, particularly with reverse rolls. In order to prevent a collision with the ionizer during roll charge, the whole equipemt has to be put to one side in a time consuming process.

A much easier solution is provided by air-supported ionizing systems. An air stream away from the ionizing source towards the surface that needs discharging carries the positive and negative ions. During this process the recombination, or electron exchange between ions, plays an important role and has to be considered.

Otherwise not enough ions would reach the roll surface and the electrical discharge would not be enough. A sufficient quantity of ions must be blown across what are sometimes quite large distances. Indeed, distances of up to 2 m between the ionizer and the roll core should not present a problem.

High performance systems

When selecting active ionizing equipment high performance systems should be used. Pressurised air dispenses through nozzles or slits transport the ions towards their target. Air purity can be clearly controlled.

Ionizers using fans to transport air-containing ions are certainly less suitable for hygienically demanding applications. This is because inside the fan dust particles may accumulate which then float off in an uncontrolled manner, thus contaminating the web material.

In order to cope with such demanding requirements HAUG has developed ionization air tunnels combined with high performance ionization rods. They can be installed according to individual requirements and, if required, outside both the maximum roll diameter and the possible space required during roll changeover.

Compressed air is hardly required as only a gentle laminar flow is required to transport the ions from the ionizer to the roll surface.

photo 2

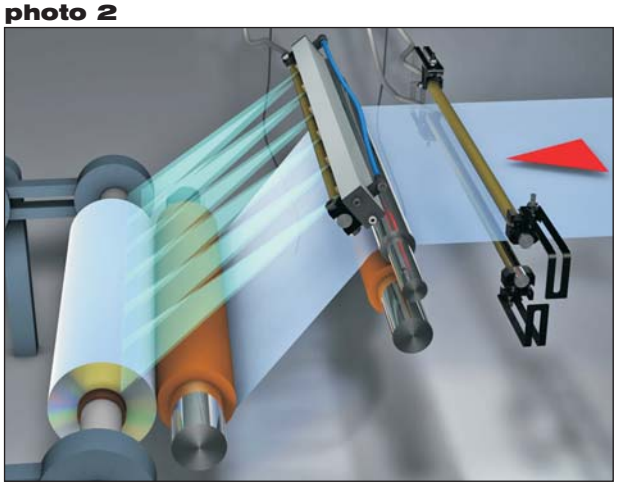
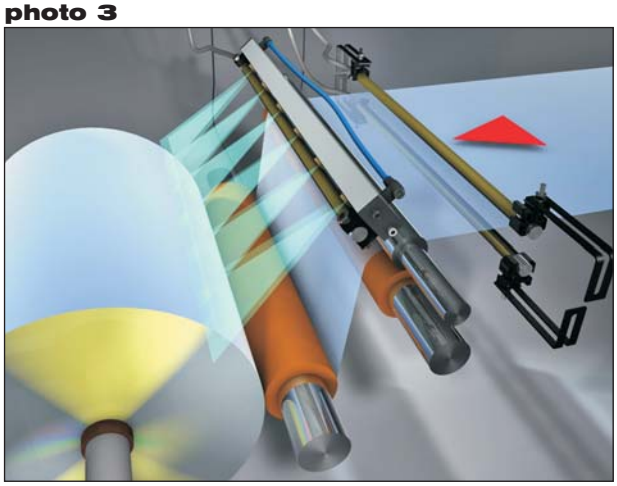


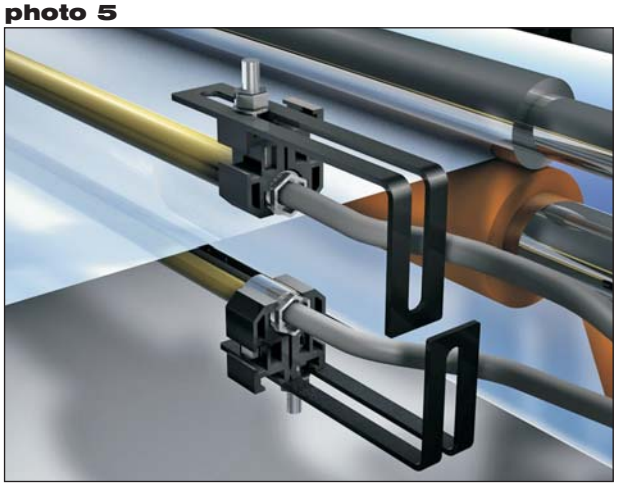
photo 3



Compressed air containing ions (light blue) flows from the KL VS ionization air lock both onto the small diameter roll (photo 2) and larger diameter roll (photo 3).

photo 4

photo 5



The material web brings along additional electrostatic charge from the machine. With the ionizing bars EI VS in front of the roll the level of static charge can be lowered to a minimum. Fixation possibilities with different types of brackets and bar holders (photos 4 and 5) enable the installation for any machine construction.

- Horst Engelmann -

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