

## Kolzer:



glass - vacuum  
treatment and its

## applications

Vacuum International presents, in this article, one of Italy's manufacturers of vacuum technology – Kolzer. During the visit to the company's premises, located just outside Milan, northern Italy, we were shown some of the historical and present machines that are used to offer metallization, sputtering, plasma and PE-CVD processes, of which 1,000 units are currently operating worldwide. Kolzer, one of the few Italian company member of SVC (Society of Vacuum Coaters), will be present at VTE 2007, hosted by Vitrum in October because, as Antonio D'Esposito says: "Glass is the perfect material."



**Growth and expansion**

Kolzer has annual growth of 20 per cent each year even if the prices of its machines remain almost the same. Expansion also means numbers and area. At present the company occupies an area of about 3,000 square meters, but by 2009 the idea is to move to an area of about 5,000 square meters.

reflective purposes. The first metallization applications were used on aircraft carriers that had to continuously metallize the reflectors that helped the planes to land on the ship. In fact, each ship has its own metallization unit.

Kolzer was the first company to import to Europe paints for plastic materials from the United States, to be combined with (and after) metallization treatment with higher metallization resistance or with more colour-ed effects.

In the 1970s, Kolzer had almost 500 employees, because at that time the market for vacuum applications underwent a considerable boom. In fact Kolzer manufactured plants for freeze-drying, refrigerator-fillers, neon-fillers, up to the ophthalmic sector, as well as its normal machines for a variety of vacuum processes. In these applications, low vacuum is used for "filling" processes, while high-vacuum enables a more complex effect on the structural and molecular level.

These changes in the applications of vacuum all took place end of the 60s, beginning of the 70s. In fact, during that period, the applications of vacuum began to evolve importantly at industrial level. The first sputtering plants were set up in 1974 – called "hot cathode" - and was a bobbin that was immersed and grown in galvanica material, to which a radio frequency was attached to the extremities of the bobbin, pulverized and sputtering therefore took place.

Kolzer started to re-utilize sputtering about 10-12 years ago on an industrial scale, where applications range from refrigeration to satellites, and is now in the world of micro-processors. Therefore, all machinery is highly protected and there are no (0 per cent) emissions from the plants.

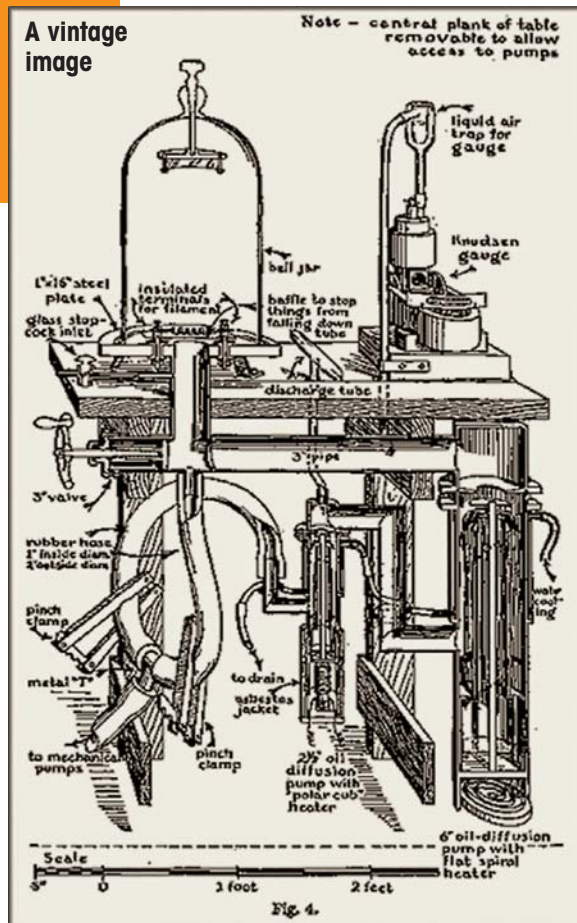
The machinery manufactured by the company ranges from small plants up to the largest with 100 inches in diameter and 150 inches in depth – the largest in Europe. However, the most sold product for Kolzer is its machine with a diameter

**THE COMPANY**

Kolzer was founded in 1950 and was one of the pioneers in early vacuum technology. The initial activities of the company were dedicated to the assembly of machinery, followed closely by research and the setting up of an operative structure near Milan for the construction and production of machinery for vacuum treatment.

The company is now in its second generation of ownership, with the two D'Esposito brothers: Antonio and Davide, with Antonio in charge of new projects and marketing and Davide as head of production. Both sons, however, have considerable experience in the activities of the company, having started to work there with their father when they were about 16 years old, starting from workshop activities.

Kolzer's staff is made up of specialized technicians, all with their own solid and extensive experience. The company also holds an English course for its personnel twice a week, for all levels of personnel.



**PRODUCTION AND MARKET SECTORS**

The two sectors that the company has always concentrated on are plasma treatment in general and deposition for metallic-style finishings. And, therefore, classical metallization in vacuum and the application of an ultra-thin layer of metal combined with a variety of colours for decorative purposes for everyday objects, as well as for optical purposes.

Deposition treatment was first used as a technology in the 1900s for



# COMPANY PRESENTATION



Kolzer's first industrial vacuum deposition plant

of 36 inches, with 400 installed worldwide in various different sectors: from aerospace (as in 1972-73 for Augusta) which is still up and running. In fact, Kolzer also gained a new contract with this company – now called Augusta Westland – for whom it supplied a vacuum cadmium plating plant to its factory in Frosinone, near Rome, where it produces helicopters. These plants carry out a “coating” of six microns to obtain anti-corrosive layers.

The company has also supplied a plant to Geox - shoe manufacturer, to enable to obtain the famous hydrophobic membrane that allows air but does not allow water in our shoes.

Kolzer has also carried out studies on wood for the American Forestry

Institute, for anti-fire, oil and water repellence. Other classical applications are those for photovoltaics, and solar thermal.

Also in this sector, Kolzer is carrying out studies on a new process for installations in China with Beghelli. Kolzer is already present in China with Altay Scientific which manufactures educational instruments there. Kolzer has also collaborated with other companies in the realization of a range of guns and revolvers for personal safety, as well as machinery installed and used in research centres where the use of vacuum technology is continuously being studied. This is mainly because of the total lack of contamination from gas in a vacuum environment. Just one of the

most important treatments to be obtained in a vacuum environment is that applied to water. The latter can become a detergent without the need of any additive.

Sputtering enables any kind of metal to be applied to any kind of substrate (also with decorative properties) with perfect optical qualities and electrical conductivity. All with respect to the environment and completely repeatable and low cost too. This makes vacuum the ideal technology thanks to its high flexibility.

In fact, other than the process, there is also the level of vacuum to be considered. And, therefore, for cold plasma, for example, we are speaking about low pressure, which ranges from  $10^{-2}$ ,  $10^{-3}$ , millibar, usually classified as a pre-vacuum environment. All depositions, on the other hand, are applied in a  $10^{-3}$ ,  $10^{-6}$  millibar environment, classed as high-vacuum. The next step is ultra-high vacuum: from  $10^{-6}$ ,  $10^{-10}$  millibar, not used in industrial applications, and only used in research and aerospace, but all with the same machine.

## Market sectors

With 98 per cent of matter in the universe formed of plasma, it has enormous potential in industrial applica-



Working procedures

tions. Plasma treated surfaces increase the processability of the same surface, while sterilizing it at the same time, eliminating all contaminants. Plasma can also substitute all cleaning processes where water is used.

Kolzer's market sector at present is first of all sputtering (in strong growth), followed by metallization of plastic surfaces for decorative applications, optical and automotive, and then plasma, used for industrial washing and sterilization.

There are many industrial sectors that are moving away from the use of dangerous substances, especially in the case of domestic appliances, where the RohS norms are in force, which restrict of the use of certain hazardous substances in electrical and electronic equipment.

## SPUTTERING

Sputtering technology represents a real alternative to definitively substitute chrome electroplating coating onto metal and plastic which is considered to be a strong pollutant and dangerous for health. As well as being the cleanest technology among the coating techniques, sputtering gives a combination of advantages like no other since it is a method of production which is economically efficient generating the thinnest and most uniform coating possible. Secondly, it is a dry process at low temperature and thirdly it forms an indestructible bond between film and substrate, since it binds them together at a molecular level.

In addition to having characteristics of hardness and resistance to abrasion, innovative colours can be obtained for decorative motifs applied to the surfaces of high quality consumer goods. It offers great versatility compared to other coatings, since being a cold transfer, it can be used for the deposition of conducting or non conducting material on any type of substrate, including metals, ceramics and plastic materials which are temperature sensitive.

Glass, because it is a hard, smooth

and brilliant material, it is the "perfect" substrate. In fact, there is no need for a coating base to prepare the surface for the sputtering process.

### *The process*

Coating using sputtering is one of the most flexible methods to physically deposit vapour "PVD" (Physical Vapour Deposition).

The coating material is inserted into the vacuum chamber as a cathode under the form of a metal plate. After the chamber has been emptied, the process gas is introduced (argon is usually used as it has a high atomic weight). A high voltage is applied and the gas is introduced. The positive argon ions go through an acceleration process on the negative cathode and then expel the atoms of the metal plate (evaporating material), which then fall onto the substrates already in the chamber and condense them. The impact of the atoms on the evaporating material produces sputtering as a result of the acceleration given by the succeeded particle.

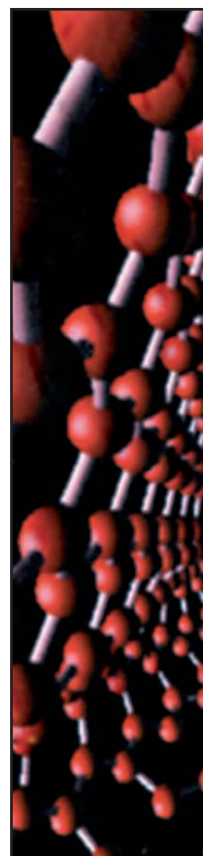
Unlike many other vacuum deposition techniques, there is no fusion of material, therefore all the metals and alloys can be deposited with high efficiency and high control.

Different cathodes made of different materials can be inserted in a vacuum coating system to produce multiple layer systems. It is also possible to modify the combination of the single layers by varying the combination of the reactive gases.

## NANOTECHNOLOGY

Kolzer is also involved in research and development activity with universities and international research centres to apply the solutions which will be tomorrow's achievements.

Solutions which are already present today in the industrial world: nanotechnology. Surface engineering, regarding atoms, has always been Kolzer's starting point for the production of innovative coatings. The objective is to develop functional nano-



structured coatings, with manufacturing processes that are ecological, simple and at the same time economical.

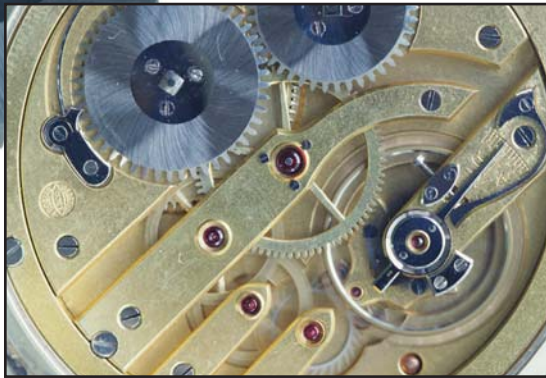
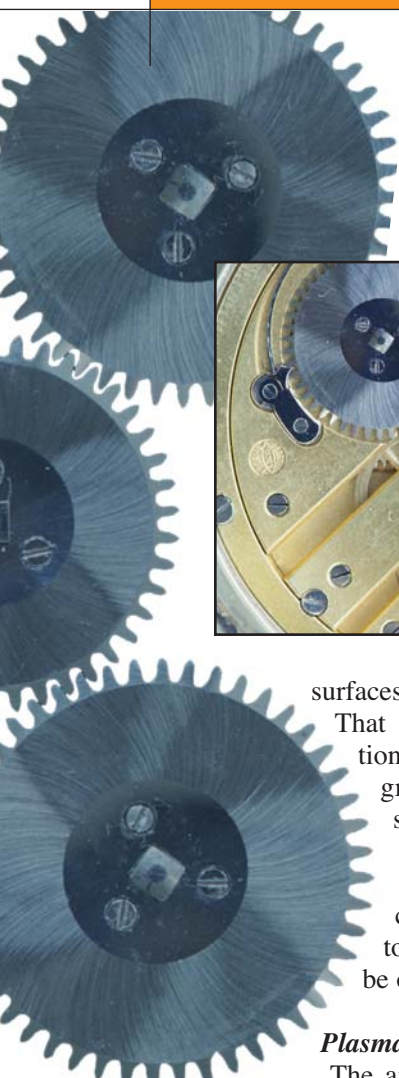
Kolzer nominates itself as promoter of production systems for industry in order to carry out the automation and feasibility of innovative processes, perfectly repeatable without end, obtaining superior levels of quality. Economical processes which consume very little; very up to date since the environmental impact is almost non existent having no production waste.

## PLASMA TECHNOLOGY

The nature of a plasma varies a lot according to the type of gas, or to the mixture of different gases, pressure of gas/gases, form of volume which confines the plasma itself, the type of electric field which supports and maintains the plasma. The plasma of particular gases, among which oxygen is always present, allows oxidation to develop at a low temperature when it comes into contact with the







cation of the surface in preparation to treatments such as varnishing, gluing, connection, coating and decoration.

The goods to be treated are inserted into the process chamber in specific loading systems (frames, trays, baskets or sifters) and are unloaded at the end of the treatment cycle.

### **Plasma deposition**

The growth of thin films on a surface can be carried out effectively through chemical

surfaces to be treated.

That is, the formation of functional groups on the surfaces themselves which permit optimal conditions for total cleaning to be obtained.

### **Plasma cleaning**

The aim of the plasma plants manufactured by Kolzer is to clean surfaces (of any nature, shape and size) and to modify the chemical and electrostatic characteristics of the surface of products. Plasma is a dry, clean process which takes place at room temperature and does not use cleaning agents (no waste material) and:

- removes organic pollutants or residual layers;
- increases surface tension and therefore surface wettability, by reducing the point of contact of liquids at optimal values;
- forms a surface which is able to react actively with the contact polymers (varnishes, adhesives, inks, etc).

By changing the nature of the process gas and their mixtures different surface characteristics can be obtained. The plants designed and produced by Kolzer are suitable for vacuum treatments of objects whose purpose is to obtain chemical modifi-

cal reaction in the vapour phase (Chemical Vapour Deposition, CVD) of composites containing the element to be deposited. Varying the process parameters, the precursors and the shape of the reactor, the PECVD technique allows numerous materials to be deposited. PECVD: Continuous research carried out by Kolzer's technicians and constant collaboration with clients and the most important science laboratories both national as well as foreign have made it possible to set up specific processes dedicated to the most varied application fields: surface hardness, low friction coefficient, anti-corrosion in acid and alkaline environments scratchproof, non stick, anti-printing and biocompatibility characteristics.

### **SYSTEM ENGINEERING AT KOLZER**

Kolzer vacuum plants consist in their main part of:

- vacuum chamber;
- vacuum pumping group;
- process chamber with cathodes which introduce the necessary energy to generate plasma;
- feeding system and control of gas flow;
- electric feeding system and plasma control;
- PLC, PC and management and control software which guarantee that the results obtained can be reproduced;
- auto-diagnosis safety systems.

The process area in plasma consists of cathodes which generate an electric discharge which supports the plasma. The cathodes are essentially stainless steel, aluminium or titanium plates onto which an electric feeding is applied (a radiofrequency, microwave or direct current). The stainless steel treatment chamber contains all the parts that operate in the real process: cathodes, gas feeders, piece holders. The chamber is internally lined with a teflon mattress. A hinged door provides complete access to the chamber. The electrodes adhere to the chamber walls. All the other groups making up the plant are connected to the vacuum chamber: pumping group, vacuum instruments, gas and electric feeders. The vacuum chamber has a spy window to check the plasma. In the testing phase, the vacuum chamber is controlled with a helium mass spectrometer to guarantee perfect hold and tightness.

### **THE PLANTS**

Kolzer's plant engineering technology stands out because it adapts its concepts to individual client requirements. In addition, Kolzer offers qualified engineering for complex production systems. The range of supplies includes plant families, from the "Mini compact plant" for research companies and laboratories, to bigger and more complex systems and special plants for in-line processes and large sized articles.

### **DGK® horizontal range**

The DGK® is the classic work system, with the most complete range of process chambers in order of size:

- DGK24" diameter 610 millimetres;
- DGK36" diameter 1,000 mm;
- DGK48" diameter 1,200 millimetres;
- DGK60" diameter 1,600 mm;
- DGK72" diameter 1,800 mm;
- DGK100" diameter 2,500 mm.

The DGK® comes with two loading systems with carriage to facilitate loading and unloading. Moreover, the sizes of the plants list-



## EMERGING ENTREPRENEURS

*In March this year, Kolzer was listed among the 30 emerging entrepreneurs in Italy for their international propensity and stock market listing. The list was made up by one of Italy's most important newspapers - Corriere Della Sera - with the collaboration of experts from ten different sectors. The resulting list was made up of 109 companies, from which the best 30 were voted.*

ed can be personalized in accordance to production needs.

### **MK® vertical range**

The MK® is the most modern and innovative work system: the material to be treated is loaded directly into the two doors of the system, for a faster work cycle.

This plant range is made up of:

- MK48" diameter 1,250 millimetres;
- MK60" diameter 1,600 millimetres;
- MK72" diameter 1,800 millimetres.

All plants have automatic process control, temperature detection, pressure and gas flow regulation, as well as different substrate supports, including patented rapid loading systems.

Supplied on request: cold/hot water feeding, cleaning plants, radiation plants and instruments for quality control, for example: Kalo-Tester, Rockwell-Tester, microscope with image elaboration.

## RESEARCH AND DEVELOPMENT

Kolzer's staff of researchers, technicians, engineers and a world network of commercial support and assistance, form a "total quality project" in which more than 900 clients all over the world, who use the Kolzer systems, participate actively and profitably. The combination of factors, key to the success of the "total quality project", has guided the company since its first steps.

## ASSISTANCE AND POST-SALES

Post-sales assistance for Kolzer begins when the machine is sold, with installation and training of the personnel who will be using the machine. Assistance is available non-stop on line. To be able to guarantee this, each and every component of the machines has its own historical certificate - where it comes from, the code number. In fact, Kolzer guarantees the components of its machines for a period of two years, while the entire machine is guaranteed for 12 years!

Moreover, Kolzer also has its own software in Windows format, which was installed on one of its machines for the first time in 2005.

Kolzer has recently sold its second

plant to Bennett Mirror in New Zealand, a demonstration of how even the different time zones do not have an effect on the assistance and collaboration with Kolzer.

Outsourcing is also an important part of Kolzer's activities. These companies are mostly located in the United States, where the components come from, and because the United States is ahead of Europe as far as vacuum technology is concerned. Automation comes from Japan and generators from Germany. Then, of course, it is the Italian ability to put together these parts to make a good machine.



### **Kolzer**

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**DGK48 Sputtering Plant**

