

## Portfolio - IPM International Perforation Management

IPM is a hi-tech company based in Germany, Asia, with specialized with highly skilled engineers and firm partners in Germany, China, Indonesia and Thailand to develop, design, tailor-made, manufacture, install, commission electrostatic micro cluster, laser perforation systems or machines for high speed webs, other material treatment or mass products.

As well sophisticated, intelligent sensor scanner porosity quality measuring units for global sales and potential clients as ready-to-use projects.

Strong hands-on engineering, necessary time at client side, qualification, trainee, technology transfer for maintenance or operation staff at high level of quality, quantity control are an essential part of our services for prosperous long term cooperation.

The founder of IPM, Mr. Werner Grosse, has been working since 1979 as application engineer, project, operation manager, technical director in the field of applied electrostatic and laser processes as well in online porosity sensor scanner measurements for tobacco, fine paper, refinement, packaging other industries.

During his professional career and collaboration in research assignments he initiated more than 46 inventions, more than 34 patents, outside of Europe and in China as well. Thanks patent grant technologies, production processes, new products properties, machines and sensor control systems has been developed. It includes worldwide new in-situ dyne control at fast moving plastic films and foils.

After he became a self employer and entrepreneur in 1992, the GmbH was established in 1993. This resulted in an expansion of micro electrostatic perforation ventilation technology for filter, cigarette, tipping, packaging, printing, cement sack, bag, food, non-woven for paper refinement and packaging industry. Since 1994 the GmbH belong to an international supplier group.

After many years of prosperous cooperation as shareholder and managing director, Mr. Grosse left the GmbH on the end of 2001 in order to enhance innovations with his own company IPM in January 2002 to design production machines which among other qualities have specific and outstanding product characteristics in cooperation with partners and relatively large clients, particular in Asia and USA.

Apart from this business, he has joined national, international organizations whose aim is to enhance innovative, creative, patent conforming and educational targets and which exchanging of technical, economical knowledge.

As a result of his membership in several organizations and due to his work in the field Mr. Werner Grosse has given many lectures, published a great number of technical papers and reports which are available in German, English, Spanish, Mandarin, French and Italian.

He received government honors from China and other countries for his expertise as foreign entrepreneur for added values of innovative hi-tech, achieved by transfer of knowledge and successful cooperation with large industry Groups in China.

### Honor China Yunnan Government

<http://bfe.yxrs.gov.cn/article.asp?id=2005092011030968>

<http://www.tobaccochina.com/news/data/20038/c815083548.htm>

<http://tobaccoreportermagazine.com/china/2004/Dec04China/Industry%20Briefs%201204.htm>

IPM with Mr. Werner Grosse and his team operates as technology experts for project management in tobacco, cigarette supplier, paper, packaging, printing, material treatment, automotive and other hi-tech industries.

In mechanical, electrical engineering, manufacturing, delivery of entire perforation electronics and long term spare part guarantees we are working many years with German suppliers.

For twin or quad bobbin, electrostatic wide web or laser micro perforation machines we are cooperating with partners and large cigarette, machine manufacture groups in China.

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## Production Technologies

### Technology

Electrostatic micro cluster perforation as material treatment, based at micro discharging and sparking, plasma tunnel effects with gas atomic ionization in Nanoseconds. Pores are normally statistical irregularly distributes in controlled size ranges from 0.1 up to 80 microns diameter and analogically, under laser or micro or macro perforation, arranged in diameter sizes from 60 to 200 microns, at best non inclined holes und holes rows of diverse arrangement comprehension. For the naked human eye invisible pores of electrostatic micro perforations may be arranged in areas, surface-all-over or zone bands with specific distances within its web. Controlled pore sizes in wide ranges from 0.1 up to 80 microns diameter by holes sequences up to 16 million pores per second and 0.1 to 3 mill Joule discharge energy for each pore. Processes and power electronics are patent grant with DE10328937.

### Performance

Arrangements of zones are usually carried out in width from 2 to 6mm and densities from 15 up to 250 pores per square cm whereas the perforation results of surface-all-over results up to 5 million pores per m<sup>2</sup>. Electrostatic perforations allows porosity levels from 80 up to 1,500 Coresta Units (ml/min/2cm<sup>2</sup> by 1,000 Pa), equality from 40 down to 6 Gurley, by material web widths from 100 to 2,000 mm by speeds of up to 500 m/min, depending on porosity and material consistency in relation to its ability to perforate.

### Physical Properties

Which can be applied to many application purposes and products containing bonded fabrics, bag or packaging papers, non-woven, etc. with gas or steam permeability but water in-permeability will be found at the application stage of the electrostatic micro cluster perforation. Which means pore sizes from 0.1 up to 80 microns up to 3 million/m<sup>2</sup>. This is due to the water greater surface tension which hampers the permeation through the relatively small micro pores.

These and other physical advantages of the relatively small pores necessarily demand the application of the cluster perforation method because alternative perforation or processes are not feasible, too expensive or simply uneconomical and would not lead to a successful application.

### Products, applications, advantages with high-holes densities micro perforation, ventilation with unique mass product properties

- Breathable, ventilated products as cigarette, tipping, filter, packaging, plug wrap, refinish or fine paper
- booklet, bible, printing, magazine, promotion, flyers or newspaper with improved or modified surface property
- decoration, gift or wall paper with thin coatings
- thin PE contacted Kraft paper for bags, cement sacks, plaster, maize, grain, pet food, granulate or powder
- for gained air outlet during filling processes with multiple time reduces efficiency
- to keep packed products in the same barrier condition than without micro perforation
- extending storage, live time or durability of certain goods and products
- joint or corner Kraft paper tapes to avoid glue bubbles and enables material diffusion
- PVC laminates or Vinyl to eliminate one side condensation effects
- or enable gas exchanges to avoid rises of mildew or rottenness
- fleece bond material with thin film layers for outdoor, under roof protection, covering of wooden houses for oxygen exchanges
- technical textiles for gas exchanges to avoid condensation processes
- breathable overalls, heavy duty or disposable work dresses, trousers, jackets, made of thin PE fleeces or other material
- biotopes and prevention of water pollution
- leather or cloth inlets for comfortable non sweat wearing under wet, high humidity and tropical condition
- soap, deodorant, hygiene, beauty creams, baby care or other packaging products which needs smell suggestion for marketing indication and sales promotions
- vegetable, flowers or food with paper packaging replacements for oxygen exchanges
- bread, rolls, fruits or food to improve freshness and aroma with paper based packing
- technical multi layer foils for industry, medical, bioengineering or filtration purposes, surface modification or improve roughness
- micro filter, membranes, battery separation layers
- bio or lab analytics, alcohol, liquid or blood filtration, clean room, agriculture plant applications
- reduction or force growth rates of bio processes

### **Simultaneous multilayer micro perforation for sack, bag and other paper products**

With several evaluation and test possibilities a new process solution is created for high ventilated sacks or bags. To micro perforate simultaneously three paper layers as multiwall or multilayer in surface-all-over design or on certain area if necessary.

Single base paper weights of 70-100 g/m<sup>2</sup>, by one layer of 15 g/m<sup>2</sup> PE coated, porosity ranges from 12 down to 6 Gurley, pore sizes from 60-100 microns, pore densities from 50,000-150,000 per m<sup>2</sup>, speeds up to 200 m/min or e.g. 280 sacks per minute are achievable.

With demands of high process efficiencies and economical aspects one online electrostatic perforation unit can add or be embedded just behind unwind stands and rolls, at printing section or entire of sack tube manufacturing line by web widths up to 1,400 mm.

Processes and devices are provided for international patent application.

### **Process integration**

Our state-of-the-art industrially approved, sophisticated, compact, multi functional, or with online sensor scanner measurement equipped, electrostatic perforation technologies operate precise and reliable 24/7, are integratable into existing rewinding, slitting, cutting, re-spooling, spreading, printing, labeling, multilayer sack, bag manufacturing or other complex production lines, machines and processes as well. Also, they can be used as completely independent offline surface-all-over or zone micro perforation units. Fully new ranges of applications enable total new products with special features, properties and market niches.

### **Laser micro perforation**

Laser perforation in general, possible to perforate by pulse or enlarge, focus laser beams are holes sizes 60-200 micron at density of holes of typical 10-30 holes per cm, sequences by 100,000-400,000 holes per second at a maximal of 16 punctured laser rows cross web with traditional systems or machines.

Means for cigarette, tipping, plug-wrap, filter, laminate, printing, flexible packaging or other material webs. By porosity levels of 100-3,000 C.U. normally in web widths 100-1,000 mm, by web speeds up to 600 m/min, depending on porosity and material consistency in relation to its ability to perforate.

### **IPM micro laser cluster perforation**

IPM laser cluster treatment perforation technology LPM-1, patent granted as DE102004001327, operates with two Co<sub>2</sub> or other laser sources inputs, up to 4 Kilowatt twin level vacuum beam multiplexer to generate up to 200 individual laser output channels, perforation or treatment heads cross web or sheet material. Combines automatic head positioning, auto focus setting, speeds up to 400m/min, flexible web width up to 2,000 mm by up to 2,500,000 holes/sec.

Jumbo roll-by-roll production, online sensor scanner permeability, porosity, perforation line measurement, trend feed-back, high automation, PLC process visualization and other features. Each laser micro perforation line can achieve 100-1,000 C.U.

### **Other industry fields**

The conception of high power, twin level vacuum, high spins laser beam splitter into the multiplexer enables many other options of industry fields as cutting, cut-off, welding, surface finishing, drilling, ablation, cleaning, micromachining, polishing, forming, melting, surface treatment, roughness improvement.

Each up to 200 laser perforation or treatment head are connected via hollow waveguide fibers HWG HCW for flexible laser beam leading cross webs or static sheet material.

To position easy fast in X-cross and Y-down web direction or exact location at static placed sheet material.

That full flexible automatic process with optical devices opening outstanding possibilities in industry, metal, plastic, domestic, tobacco product, medical, hygienic, wall covering, security cards, bank notes or food application. LPM-1 means cluster treatment at wide web, surface-all-over, line, zone or other materials.

### **Anti piracy, counterfeiting laser product design**

As known offline laser perforation machines and processes are generating straight holes line in web direction at running tipping paper or other material sheets. Excluding spray laser designs which look similar as random holes into certain zone areas as electrostatic perforation.

The patent pending DE102004012081 Micro Laser Line technology generates cluster pattern, micro holes, sinus, waves, zigzag, cryptograms, logos, perforation scripts, holograms, brand names or other kind of micro perforation designs in web direction which can look like a group of micro laser lines.

Concerned tipping paper means non coaxial circumference at the cigarette filter. High speed spins laser beam divert, steering, mirror scanning, flipping element controls each single laser beam and perforation line cross material which are precise focus for micro holes in ranges from 50-120 micron. Co<sub>2</sub> or other laser sources are to use.

### **Ultra high speed laser beam steering**

Technologically performed as ultra fast scanner device up to 4,000 Hz or 240,000 rpm as real galvanometer alternative, precise laser beam deflection up to 4 Kilowatt optical power by 8-14mm diameter, actuator with metal optics or asymmetrically, rotary reflection cones which movement sequences are precisely synchronized with material speed. Envelope curves of selected perforation pattern are stored and calculated by PLC control before single hole and hole groups supervised during production processes.

Product process advantages enable total different product indicators and milestones against other laser perforation or treatment processes which allows significant product property, trademark indications, IP claims, unique company features as micro perforation of tipping, cigarette packaging, other paper or material.

[E.g. wide laser perforation group as common active ventilation zone to obtain smoking advances with better air stream distribution into the cigarette filter.](#)

Perforation line guiding around the cigarette filter rod, tipping paper strip by freedom of lips area, other food, domestic or industry products assure constant porosity results.

Several pattern or wave line design for different brands, number of holes or pattern per cm length are constant e.g. 10-20, total porosity 100-1,000 C.U., hole sizes by 50-120 microns, densities 100,000-500,000 holes per second in total, 1-6 perforation pattern, lines, marks or scripts can combine in one group, micro perforation holes, pattern quality or porosity remains in standard levels.

Other flexible web material, substrate, products are treatable in similar processes, at existent laser perforation machines are able to modify with new optical, sophisticated mechanical, control elements.

Modification with low investment, finance budget because exchanging of certain elements, complete devices are adaptable at existent offline laser perforation machines or other systems.

Capability to adapt super speed beam steering devices or units at online perforation units at cigarette making machines up to 12,000 cpm.

### **Power switching converters**

IPM developed a dual high power, high voltage, medium frequency switching converter which works with hybrid drives, full in order of EMI, EMV, NEC, CE restrictions, compact semiconductor power electronics stages, supporting capacitors and ferrite transformers generating ultra short high voltage pulses and sparking bursts. Advantages are based on uses of standard circuits with extended semiconductors for cluster, corona substrate treatment, ac/ac, ac/dc, converter, drives, frequency, upward, downward converter, power electronics supplies.

[Industry applications for electrostatic micro cluster perforation, converting, drives, others with IGBT, MOSFET, HVFET power stages. In high power, high current, high voltage circuits to obtain micro perforation, surface treatment, modifications, corona treatment, drives or other switching applications by frequencies up to 250 KHz, Uce up to 1,400 Volt, power levels up to 50 Kilowatt.](#)

Higher power efficiencies by low switching losses are further advantages. Precise pulse timing by certain time window with constant or variable frequencies generating high voltage sparks and holes sequences into fast moving flexible materials. Repeat frequency of entire circuit can be up to double switching frequency of each semiconductor. The patent is granted as DE10328937.

### **Online porosity sensor scanner measurement**

Patent pending DE10251610, patent grant in China 200310104764 for stationary or sensor scanner measuring at flexible webs or other material sheets to detect very precisely, reproduce their specified product properties while production.

OPSS-1 OPRL-1 sensor control systems are equipped with multiple monolithic color sensors, precision line lasers, CCD image devices and internal ATMEL controller, firmware, high-speed data link, scanning speeds 20-500mm per second, flexible material web widths up to 5,000 mm, measuring gaps 2.0-5.0 mm, inline detection of permeability, porosity, spectral transmission, opacity, extinction, particle absorption, porosities 80-5,000 C.U. respectively from 50 down to 3 Gurley, speeds up to 600 m/min, position control of perforation lines with 0.1 mm accuracy, 0.1-200 microns pore diameter by up to 300 pores per cm<sup>2</sup>.

Real time data determining of certain parameters, optical transmission, spectral grades, porosity integrals, envelope curves, internal calculated measuring values.

Thus direct with close-loops and feedback to power electronics of fabric treatment units. Micro perforation or other system makes it possible to compensate small changes in web treatment parameters and their partial locations. That each jumbo roll as well single, twin or quad bobbin sets can be quality controlled without intermediate stops in order of ISO 9001/9002 demands.

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## **IPM – Technologies - Production Machine – Product - Services**

**Electrostatic micro perforation machines PS-1000-2, PS-1200-3, PS-1600-2, PS-2000-1** for cigarette, tipping, filter, packaging, plug-wrap, fine, Kraft, sack, bag other paper products by base weights 30 up to 160g/m<sup>2</sup>, material web widths 50 up to 2,000 mm, porosities from 80 up to 2,500 C.U. or down to 6 Gurley, hole sizes from 10 up to 100 microns, hole densities from 120 up to 260 holes per cm<sup>2</sup>, zone widths from 2.0 up to 6.0 mm, up to 16,000,000 holes per second, up to 3 Million/m<sup>2</sup> in surface-all-over design by speeds up to 500 m/min. Multiple web path, up to 54 perforation channels, electrodes pairs or 27 final bobbin sets, jumbo roll-by-roll production up to 25,000 meters, S7-PLC- controlled hi-tech automation, OPSS-1 porosity sensor scanner position, simultaneously porosity measurement and trend feedback by industrial PC automated control. Annual production output e.g. 4000 tons of tipping paper by 220 C.U. with multiple perforation heads. Patent granted DE10328937.

**Twin bobbin tipping paper laser perforation machines L-400** in cooperation with laser system manufactures in China, porosities from 100 up to 1,500 C.U., holes sizes from 80 up to 150 micron, densities from 10 up to 20 h/cm by up to 150,000 holes per second. Annual production output up to 30,000 bobbins by 300 C.U.

**Quad bobbin tipping paper electrostatic micro perforation machines PS-250-4** up to 4,500 meters bobbin length, slim rolls up to 25,000 meters at unwind section, roll-by-roll production with 16/24 bobbins no stop, with or without integrated slitting, flying-splice unit for simultaneously quad bobbin set production, OPSS-1 online porosity sensor scanner control with close loop, perforation feedback, quality and quantity control of each perforation zone, porosity ranges from 80 up to 800 C.U., deviation CV <3 % by 260 C.U., tipping web width up to 300mm, speeds up to 600m/min, hole densities from 120 up to 260 h/cm<sup>2</sup>, zones from 2.0 up to 6.0 mm width, holes from 10 up to 70 microns, up to 7,000,000 holes per second, annual output up to 120,000 bobbins by 300 C.U. High automation level with S7-PLC and industrial PC automation control. Patent granted DE10328937.

**Porosity sensor scanner measurement OPSS-1-A/B, OPRL-1-A/B** for electrostatic or laser perforation machines, porosity from 80 up to 5,000 C.U., feedback of each perforation zone, porosity with multi colour sensors, zone and line position control, accuracy 0.1mm with precise laser line, own sensor controller firmware, hi-speed serial link up to 230,400 Bit/s, RS-232, RS-485, Ethernet, USB, industry PC, C++, process visualization for quantity, quality, statistics, fibre linked to PCC/QCC. Patent pending DE10251610, China patent granted 200310104764.

### **IPM service**

Technology expertise, project management, consulting, international engineering, industrial proofed improvement, modification, retrofit, overhauling, manufacturing, sales, installation, commissioning, service for tailor made, turn-key electrostatic or laser micro perforation machines, online porosity sensor scanner systems and production lines world-wide.

Press releases and reports are published at websites: engineering and manufacturing par excellence for client satisfaction, disciplined competence for long lasting partnership with cigarette making, supplier, paper refiners, packaging and other worldwide industry groups.

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## **Cooperation with Chinese partners**

**MLL-1 laser line cluster perforation, ventilation, anti piracy design** for tobacco or other mass products, enables advance smoking air streams into cigarette filters by further product advantages, high speed rotation of un symmetrically mirrors, cones for laser beam steering, up to 240,000 rpm, holes sizes from 60-150 microns, densities 10-30 h/cm, porosities from 100-1,500 C.U. by up to 300,000 holes per second.

The MLL-1 micro-laser-line perforation and material treatment enables large numbers of capabilities for hole or treatment positioning with different pattern, design, waves, zigzag, cryptograms, scripts, lines for unique anti counterfeiting indication and others. Special remark of MLL-1 creates fundamentally new product properties, e.g. final products for mouthpieces with tipping paper at cigarette filter or other tobacco, cigarette packs, packaging or security products. Specific indication of brand names which are recognizable for everyone and product buyer, if the micro holes or pattern are to see with magnified glasses only.

Or touch able as Braille scripts as micro cluster cryptograms. Patent pending DE102004012081.

**LPM-1 wide web laser micro perforation machine, sheet material treatment** particular for paper products as cigarette, tipping, filter, packaging other mass material production, up to 200 laser perforation or treatment heads cross web or sheet material, automatic head positioning, focus setting, dual 4 Kilowatt Co2 others laser source inputs, beam factor  $M2 < 0.9$ , twin level multiplexer, flexible hollow fibres, web widths up to 1,200 mm, speeds up to 400 m/min, 25,000 metres jumbo roll-by-roll, fully automatic production, PLC process visualization. Integrated OPSS-1 porosity sensor scanner control, perforation holes from 60-150 microns diameter, densities 10-30 h/cm, porosities from 100-1,000 C.U., up to 2,500,000 holes per second, annual production output up 1,800 tons by 400 C.U. Patent grant DE102004001327.

**OESP-1, OLP-1 ventilation for mass products at cigarette makers or packers** development with a Chinese firm consortium, uses of IPM mini laser multiplexer and hollow fibers up to 3,000 mm length, see above patent, designed for 4 or 8 laser perforation lines, sealed-off laser source 400 Watt, 48-64 mm bobbin width, precise perforation round or oval holes from 60-150 microns, porosities from 100 up to 900 C.U., cigarette ventilation levels from 10-80% by twin or quad lines at each bobbin strip side, up to 14,440 holes/s in total, up to 12,000 cpm or speeds up to 150 m/min.

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### Press release example

**Flexo & Gravure Asia 1-2008** [http://www.flexo.de/download/fga/1-2008/Inhalt\\_FGA\\_1\\_2008.pdf](http://www.flexo.de/download/fga/1-2008/Inhalt_FGA_1_2008.pdf)

On requests - more details about projects references in tobacco and packaging industry.

**Patent download** <http://www.microperforation.com/englishengineerreport.html>

**Link** <http://www.microperforation.com/ipm-technology.html>

### Patent references

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