HOW MOLECULAR PLASMA GROUP (MPG) CAN HELP IN THE FIGHT AGAINST COVID-19 BY ENHANCING SAFETY AND EFFICIENCY OF PERSONAL PROTECTIVE EQUIPMENT

In the present context of the COVID-19 pandemic, use of face masks has been recommended by the *Centers for Disease Control and Prevention* to reduce the chain of transmission. This will most likely become a new global norm in the coming years – as is already the case in several Asian countries. High-performance protective masks (FFP2-like) and other personal protective equipment (PPE) dedicated to medical personnel, rely mostly on mechanical filtration of air- or bioaerosol-borne pathogen agents. Incorrect handling of masks and PPE still put users at contamination risk.

As we all know in the ILTP Community, low-temperature plasmas can be used as a realistic and powerful tool to decontaminate sensitive materials, due to their abundant production of reactive species, including high energy electrons, metastable atoms, reactive oxygen and nitrogen species (RONS), and also UV radiation. As most of the currently available PPE are designed to be disposed after use, materials used for their confection are cheap and fragile (e.g. polymers, paper). The use of cold plasmas for decontamination – inactivation or "killing" of micro-organisms – is a well-documented topic, and still is under investigation in view of mask decontamination.

But there is much more that cold plasmas can enable. Addition of anti-viral and antibacterial agents, in the form of ultra-thin (tens of nm) coatings, would significantly enhance safety, performance, and possibly lifetime of protective masks and other PPE. This way, PPE would not act only as a simple "barrier" to pathogen agents. The additional nanometric functional layer would offer active disinfection properties while being harmless to the user.

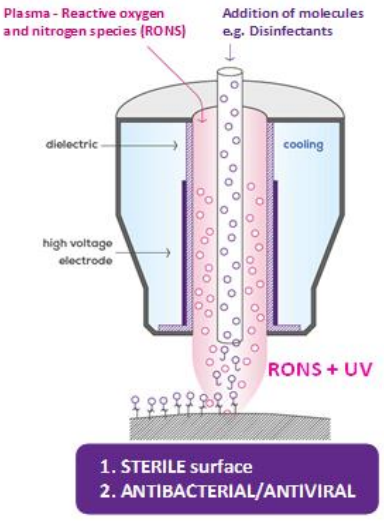
OUR TOP-PRIORITY OBJECTIVES IN THE FRAME OF THE PANDEMIC:

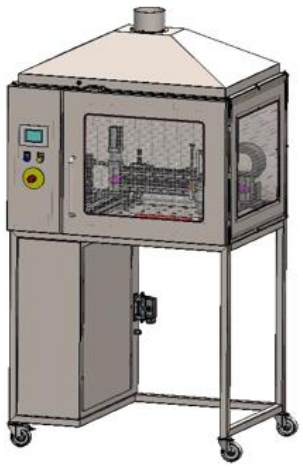
- ✓ **PRODUCTION OF FACE MASKS / PPE WITH ENHANCED PERFORMANCE, SAFETY AND INCREASED LIFETIME**, through coating with antibacterial and/or anti-viral additives that can be strongly bound to the material without degradation.
- ✓ **HIGH-THROUGHPUT DECONTAMINATION OF USED FACE MASKS / PPE** without damaging the mechanical and filtration properties.

Several pathways are currently being investigated: gas plasma only, plasma with the addition of water micro-droplets – the so-called plasma-activated water ("PAW") approach –, plasma with the addition of antibacterial and/or anti-viral additives.

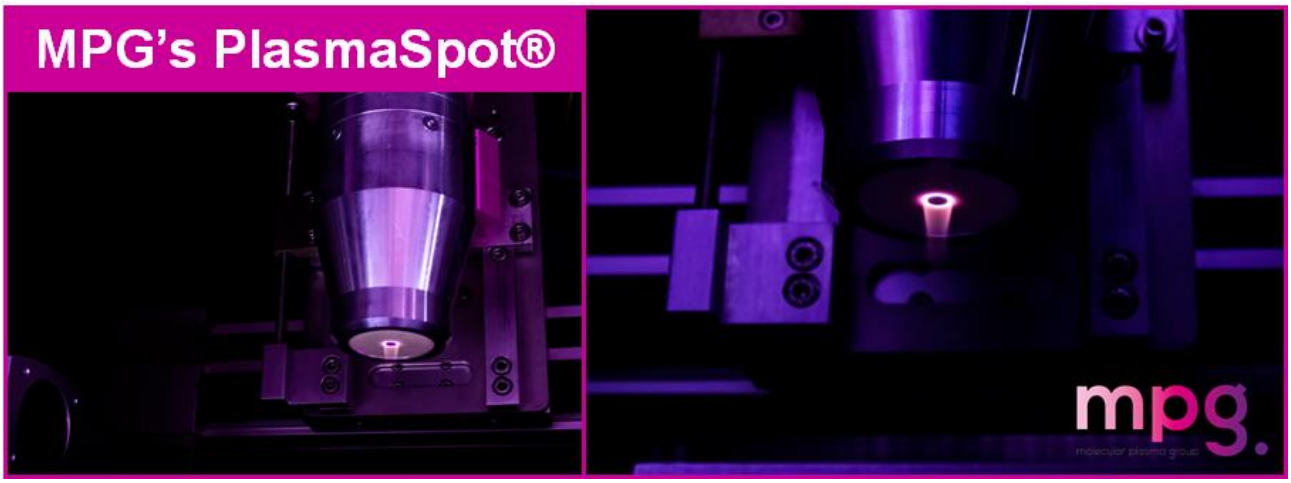
OUR SOFT, ATMOSPHERIC PRESSURE COLD PLASMA TECHNOLOGY

Our technology, is based on optimized and highly-controlled cold atmospheric plasmas that permit synergistic combination with chemicals or other additives. It is a versatile, easily transportable on-site technology that enables single step, fast processes for surface treatment of sensitive materials, among which are: paper, plastics and textiles. MPG's proprietary atmospheric plasma deposition technology enables, not only the decontamination aspect of the plasma source itself, but most importantly, the possibility to add chemicals – without any limitations regarding the state of matter. This will enable production of anti-viral/antibacterial safety masks and other PPE.





MPG Mobile Equipment



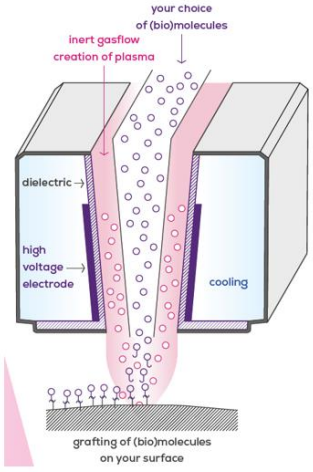
ADVANTAGES OF OUR TECHNOLOGY:

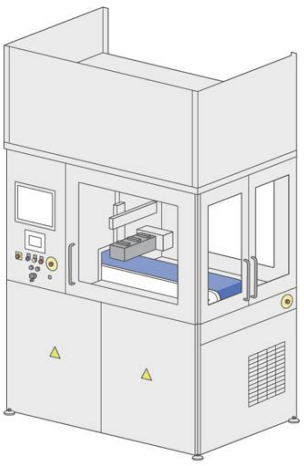
- ✓ Environment-friendly treatment: no waste products generated, only a fraction of the chemical disinfectants is being used compared to chemical processes
- ✓ Room temperature treatment, no degradation of the intrinsic properties of the masks/PPE
- ✓ Readily scalable technology, continuous web treatment of technical textile, much easier and faster than batch processes thanks to the operation at atmospheric pressure
- ✓ Mobile technology, transport of the equipment and on-site treatment possible
- ✓ Low-capital intensive technology compared to the alternative ones

TOGETHER, LET'S MAKE IT HAPPEN!

In close collaboration with several industrial partners and research institutes, we are currently "doing our homework", to validate our approach. For example, we are working with the Luxembourg Institute of Science & Technology (LIST) – who have the capacity to perform antimicrobial/anti-viral testing to develop plasma-based deposition of antimicrobial/anti-viral compounds on PPE such as gowns and mask as well as decontamination of PPE. On the Belgian side, we have recently entered a mask decontamination study in Wallonia (See https://borsus.wallonie.be/home/presse--actualites/publications/la-wallonie-se-lance-dans-la-production-et-la-decontamination-de-masques-chirurgicaux.publicationfull.html). Outcomes of these initiatives are expected in a few weeks.

In a second step, the optimized set of parameters will be used in a scale-up phase towards high throughput coating and decontamination, taking into account performance, time constraints and economic viability. Target is to build an industrial-scale line, aiming to reach TRL 7 – Prototype demonstration in operational environment and TRL 8 – System complete and qualified. The scaled-up prototype will embody an existing industrial plasma treatment tool, MPG's PlasmaLine® which is scalable up to a working width of several meters.





ABOUT US: Created as a spin-off from VITO (Belgium) and the Luxembourg Institute of Science and Technology (LIST) to commercialize a unique nano-coating technology using cold atmospheric plasma, Molecular Plasma Group SA was established in 2016. We are providing industrial plasma equipment dedicated to surface modification and functionalization. The plasma deposition process of Molecular Plasma Group SA is a disruptive Key Enabling Technology (KET) that enables the creation of a wide range of advanced surface functionalities. Examples of what can be achieved using our atmospheric plasma deposition process include: adhesion promotion, silicone-free release properties, tunable super-hydrophobicity or hydrophilicity, one-step immobilization of biomolecules, microfluidic channeling, and much more. Our MolecularGRIP™ technology is currently the main pillar of our business; it ensures perfect adhesion on the most inert (PTFE, Carbon Fibre, Polyolefins, Titanium…) and sensitive (Natural Fibres, Cellulose...) substrates.

As a full-service provider, Molecular Plasma Group SA offers application development as well as design, construction and servicing of equipment ranging from lab systems for R&D centers and universities, up to industrial in-line systems for continuous production. Our customers are active in a wide range of industries such as fundamental and applied research, aerospace, aeronautics, automotive, packaging, biotechnology, biomedical engineering, micro-electronics, electronics, etc.

One of the main focus areas for MPG is the biomedical industry. We were selected for Luxembourg's Fit4Start Health Tech accelerator program and successfully graduated in Q1/2019. This resulted into two patent applications on biomedical methodologies: (i) anti-biofouling / antibacterial / anti-viral surface, (ii) biomolecule immobilization.

More at: https://www.luxinnovation.lu/news/from-spin-off-to-technology-platform-the-mpg-story/

Visit our website: https://www.molecularplasmagroup.com/

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