

HYGIAFELT® – reusable barrier Patch with biocidal properties, self-decontaminating and sterilizable

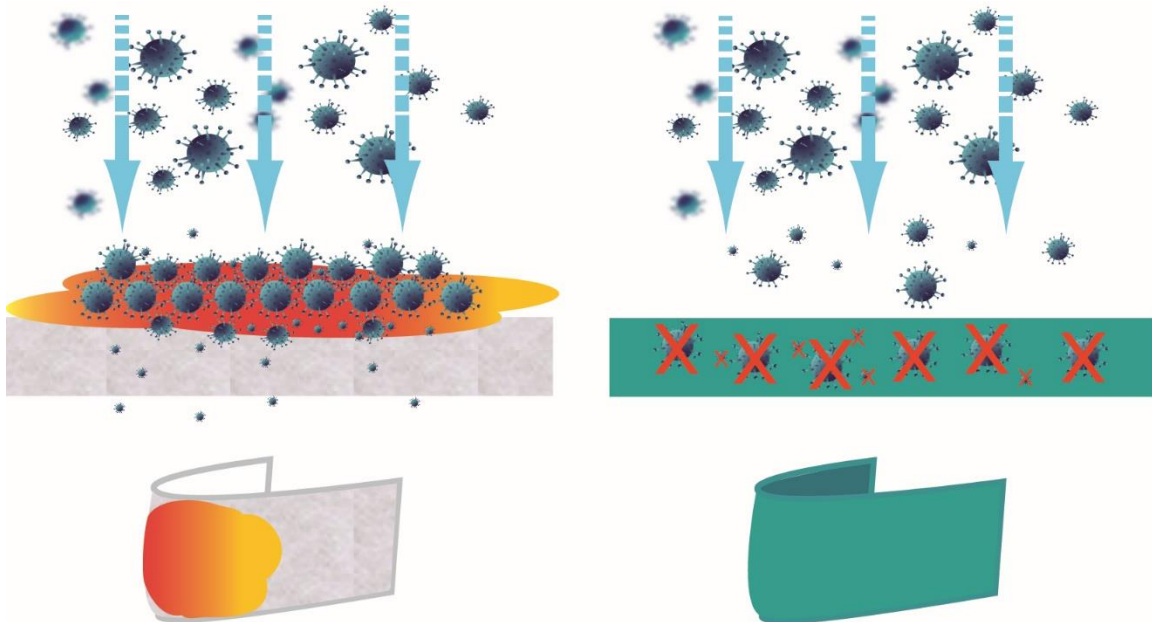
In the actual context, AJELIS receives numerous demands to elaborate an antibacterial/antiviral material and all of our skills are gathered to reach this goal regarding the COVID-19 crisis.

For 10 years, our AJELIS team has been working on immobilization of different molecules on polymer fibers and, today, **we have immobilized copper and some other biocide agents on these polymer fibers** creating the **HYGIAFELT®** material.

How it works: bacteria and viruses are deactivated when passing through this additional filtering barrier.

Single-use surgical and FFP masks filter the viruses and bacteria they accumulate on their surfaces, favoring the continued growth of pathogens.

HYGIAFELT® fibers are self-decontaminating thanks to the presence of copper.



Standard material with passive filtration:
pathogens accumulate on the surface
with an additional infectious risk

Hygiafelt® biocidal material with active filtration :
pathogens are destroyed.

HYGIAFELT®'s breathability is 6 times higher than the standard NF EN 149 and the aerosol protection (droplets) is close to 99% for a standard EN 14683 at 95. The complete elements are communicated below in an extract from the report of the tests carried out by DGA Maitrise NRBC (Vert-le-Petit). To these performances is added a biocidal activity of the HYGIAFELT® material. It constitutes a major and additional asset in high level of infectious risk situations.

These textiles act as an additional decontaminating barrier to usual materials used in air filters or protective masks FFP2 or other which have only mechanical filtration of particles or water droplets without deactivating them.



HYGIAFELT® – Cu :

Reusable barrier-patch with biocidal properties, self-decontaminating and sterilizable

Copper is known for its bactericidal properties¹. As an example, this article in the newspaper Le Figaro which reports that "in contact with micro-organisms, positive ions of copper, create a kind of " short circuit ", which causes holes in the membrane of bacteria and thus kill them in one or two hours ". The 2008 article in the Inter-bloc newspaper said that "based on a series of laboratory experiments demonstrating the effectiveness of copper in eliminating five different strains (Staphylococcus aureus, Enterobacter aerogenes, Escherichia coli, Pseudomonas aeruginosa, Methicillin-resistant Staphylococcus aureus), the United States Environmental Protection Agency approved copper and its alloys in the first quarter of 2008 as antimicrobial agents.² Another article in the journal Science et Avenir of 2011 confirms that more than 99% of bacteria die on a copper surface after two hours of contact and in the same way for the influenza A virus (according to work by Pr. William Keevil)³. An international scientific journal "the Journal of Applied and Environmental Microbiology" describes results of tests for deactivation of the influenza A virus and notes that (English translation) "that copper surfaces act as control barriers capable of reducing transmission of the virus, especially in institutions, such as schools and health care units, where viral contamination has the potential to cause serious infections »⁴ and a last article published in the PLOS describes positive results of copper action against Norovirus.⁵

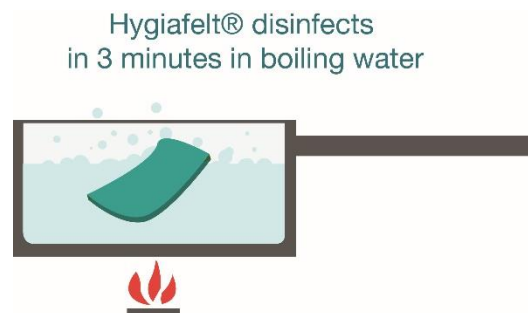
HYGIAFELT® patch composition: Non woven textile felt (PAN/PET/PP) and copper. The particular know-how of AJELIS allows these fibers to be loaded with copper in a stable and secure manner (10% by mass). The presence of copper is characterized by the green-blue color of HYGIAFELT®-Cu. The patches are sterilizable. No release of biocidal compounds has been observed during its use, or even during and after sterilization in boiling water.

Sterilization and reuse:

The benefit of HYGIAFELT® biocidal properties is also accompanied by the benefit of possibility to **sterilize and reuse these materials.**

Bacteria and viruses are already deactivated when passing through this filter barrier, but complete sterilization will always be desirable. Since the COVID19 virus destroys at 60 ° C and the other pathogenic organisms between 70 and 100 ° C, the safest way to sterilize HYGIAFELT® is to put it into boiling water.

Our repetitive tests carried out under sterilization conditions in boiling water for 3 minutes and in wet steam for 15 minutes did not detect the copper leak in the HYGIAFELT® disinfection water. No loss of copper was observed.



¹ <https://sante.lefigaro.fr/actualite/2015/03/04/23471-contre-maladies-nosocomiales-enduit-innovant-cuivre>

² <https://www.em-consulte.com/en/article/187978#N10036>

³ https://www.sciencesetavenir.fr/sante/contre-les-microbes-le-retour-du-cuivre_25529

⁴ J. O. Noyce, H. Michels, and C. W. Keevil APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Apr. 2007, p. 2748–2750 ; Warnes SL, Keevil CW (2013) Inactivation of Norovirus on Dry Copper Alloy Surfaces. PLoS ONE 8(9): e75017. doi:10.1371/journal.pone.0075017

⁵ Warnes SL, Keevil CW (2013) Inactivation of Norovirus on Dry Copper Alloy Surfaces. PLoS ONE 8(9): e75017. doi:10.1371/journal.pone.0075017

Context:

The past few weeks have seen a shortage of masks. Doctors, liberal nurses, police, firefighters and all medical staff in hospitals did not have access to these masks when they were in contact with many infected people. This is what led us to develop sample patches, free of charge, using the available raw materials in our stocks. We are convinced that this material will have its usefulness as an additional barrier for treating bacteria and viruses.

Examples of immediate patch application:

- **Patches for hygiaphones** with perforated megaphone: instant installation with a tape directly on the bay window or plastic at the level of the " megaphone" or of the liftable document pass
- **Mask inserts**



Barrier-patch taped on the bay window



*Mask model made by AJELIS according AFNOR standards (France)
contact@ajelis.com*



*Mask model made by Atelier of Leila BAIRI
creaciba@contact.com*

Warning ! If the patch is used with a mask, do not put it in direct contact with your nose or your mouth.

- **Patch-barrier** taped on the outside of the surgical mask.

If you do not have a mask with an integrated pocket or an insert, cut the patch and attach it with scotch tape or any other means to easily recover it for sterilization. Total disinfection is done by placing the patch in boiling water or steam for 3 minutes. This operation must be done after every 3-4 hours of use of the patch. It is well known that a temperature from 70 to 100° C (from 158 to 212 °F) totally kills most of bacteria and viruses.



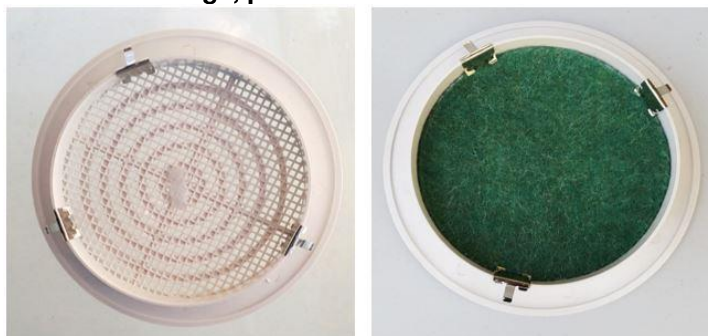
Patch taped on FFP2 and surgical mask

- **Half mask inserts**



NEEOBREATH®, made by Atelier de Guillaume Turbec, in waterproof neoprene. The air only passes through locations equipped with patches (<https://www.facebook.com/watch/?v=2686907191554087>), guillaumeturbec@gmail.com.

- **Ventilation filters for buildings, planes or trains**



Domestic aerator simulating a disinfecting filter in a ventilation system

HYGIAFELT® is easily calendered with the polypropylene used in standard masks of for air filtering.



Biocidal insert coated with standard PP material filtering particles

HYGIAFELT® Patch has successfully passed the DGA breathability tests (27.03.2020). Breathable material, it is in accordance with standard NF EN 149 and filtering aerosol particles of 1 and 3 µm in accordance with standard EN 14683 (DGA tests).



		Measure	Standard
Air permeability in liter.m ⁻² .s ⁻¹	At depression of 100 Pa	686 L.m ⁻² .s ⁻¹	> 139 L.m ⁻² .s ⁻¹
Air permeability in liter.m ⁻² .s ⁻¹	At depression of 100 Pa	290 L.m ⁻² .s ⁻¹	
Protection efficiency aerosols in %	Particles 3 µm	98.9 %	> 95 %
Protection efficiency aerosols in %	Particles 1 µm	98.7 %	



MINISTÈRE DES ARMÉES



DIRECTION TECHNIQUE

Rapport	Titre	Rapport d'essais
	Référence	RP/20-1958/DGA MNRBC/2000305/NP Version 1
Prestation	Intitulé	COVID-19 masques
	Référence	2000305
	Destinataire	AJELIS

3. RESULTATS

3.1. Matériau

Cas d'usage		Protection du porteur (1) (Masque type FFP2)		Rétention des projections (2) (Masque type chirurgical)	
		Mesure	Attendu	Mesure	Attendu
Perméabilité à l'air (en litres/m ² .s ⁻¹)	à dépression 100 Pa	non mesuré	-	686 L.m ² .s ⁻¹	≥ 139 L.m ² .s ⁻¹
	à dépression 40 Pa	non mesuré	-	290 L.m ² .s ⁻¹	-
Efficacité de protection aux aérosols (en %)	Particules 3 µm	non mesuré	-	98,9 %	≥ 95 %
	Particules 1 µm	non mesuré	-	98,7 %	-
	Particules fines 0,2 µm	non mesuré	≥ 94 %	non mesuré	-

(1) Usage protection du porteur : flux mesuré de l'extérieur vers l'intérieur, à l'inspiration

(2) Usage rétention des projections : flux mesuré de l'intérieur vers l'extérieur, à l'expiration

4. CONCLUSIONS –

Le matériau A de la société AJELIS présente des performances en perméabilité à l'air et en efficacité de protection compatibles pour un usage de type masque chirurgical.

HYGIAFELT® is a breathable material that meets the standard NF EN 149 and filters aerosol particles of 1 and 3 µm in accordance with standard EN 14683 (DGA tests). HYGIAFELT® does not yet benefit from certification or homologation in France for surgical masks. By reason of shortage of FFP2 and surgical masks this material can be used for Barrier masks in case that the mask will be sewn in accordance with AFNOR Spec. AFNOR Spec – Barrier masks V1.0⁶ can now be used by any companies or public services wishing to order masks for their employees from a manufacturer. According to the Direction Générale des Entreprises - Masks Unit, the sales of masks for the public and associated protective materials that have passed the DGA tests are not subject to authorization or approval. The use of these masks is part of the strict application of containment measures, work organization measures and barrier gestures.

Usage and safety tips for HYGIAFELT® patches

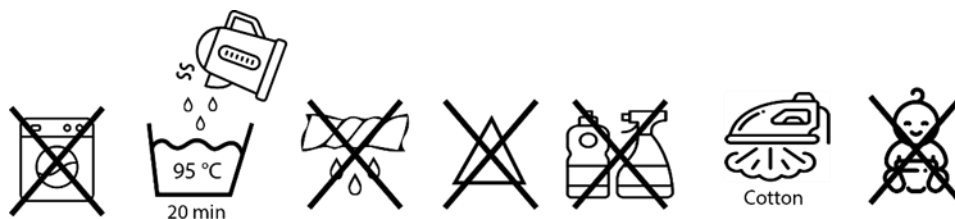
Mask inserts. Put your Patch inside of barrier craft mask or scotch it to outside part of surgical mask. Manage your mask according to general guidance of World Health Organisation⁷.



Sterilization of Patch. **Remove the Patch from the mask before washing.** You can sterilize the Patch using a kettle: place the Patch in a container resistant to boiling water, boil the water and pour it over the Patch. Leave to cool for 20 minutes then dry the Patch for a new use.

⁶ <https://www.afnor.org/en/news/protective-masks-download-our-reference-document-for-free/>

⁷ [https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-\(2019-ncov\)-outbreak](https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak)



Warning !

Use is under your sole responsibility and must be carried out in strict compliance with the following recommendations:

Do not machine wash. Do not put the Patch in contact with laundry or household disinfectant products having an acid or base nature.

If used in a mask, do not put in direct contact with your nose or your mouth. As for every non-woven felt, tiny bits of fiber can come off. If you are allergic to felt, acrylic fibers or copper, you should not use them.

KEEP OUT FROM THE REACH OF CHILDREN. Do not leave within the reach of children to prevent accidental ingestion risks.

At the end of the period of use of this patch it will be necessary to disinfect it one last time. You can put it in the trash like household garbage.

Please, be reasonable. Obviously, do not eat this patch, or put it in the toilet, or use it in a way that we would not have even imagined!!! The funny proposals of use can be sent to contact@ajelis.com for validation from the scientific team or just for a laugh.

More seriously, all ideas and advice, from scientific or diverse circles are welcome on the use of this material. Let's act together against COVID-19!

AJELIS team

April, 19th 2020

AJELIS is a young innovative company born from a partnership between the Atomic Energy Commission of Saclay (CEA) and the University of Paris-Sud.

The core business of AJELIS is the elaboration and manufacture of fibers and textiles for the cleaning of water and air. Our filters are installed on industrial sites in Europe for the capture of harmful pollutants from waste water to the environment (eg heavy metals, acids, bases, certain VOCs) and for the management of emergency situations.