GLATFELTER

TECHNICAL INFORMATION BULLETIN

August 2020 / FACE MASKS

Glatfelter has created this whitepaper in response to increasing inquiries and frequently asked questions about face masks from business contacts across the globe. For years, Glatfelter's engineered materials have provided high performance solutions used to make medical face masks. This whitepaper provides a brief introduction of the functionality, material and effectiveness of face mask solutions. Please note that this paper cannot cover all the information needed to produce face masks, but we hope it will act as a useful primer and introduction to this subject.

CONTENT

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1. BACKGROUND

Face masks have become essential personal protective equipment during the COVID-19 pandemic. Several countries have announced the mandatory use of face masks in public areas, when using public transportation, and in grocery stores and shopping centers. Wearing face masks in public is highly advisable to reduce person-to-person transmission for COVID-19 and prevent further lockdowns (World Health Organization, WHO youtube).

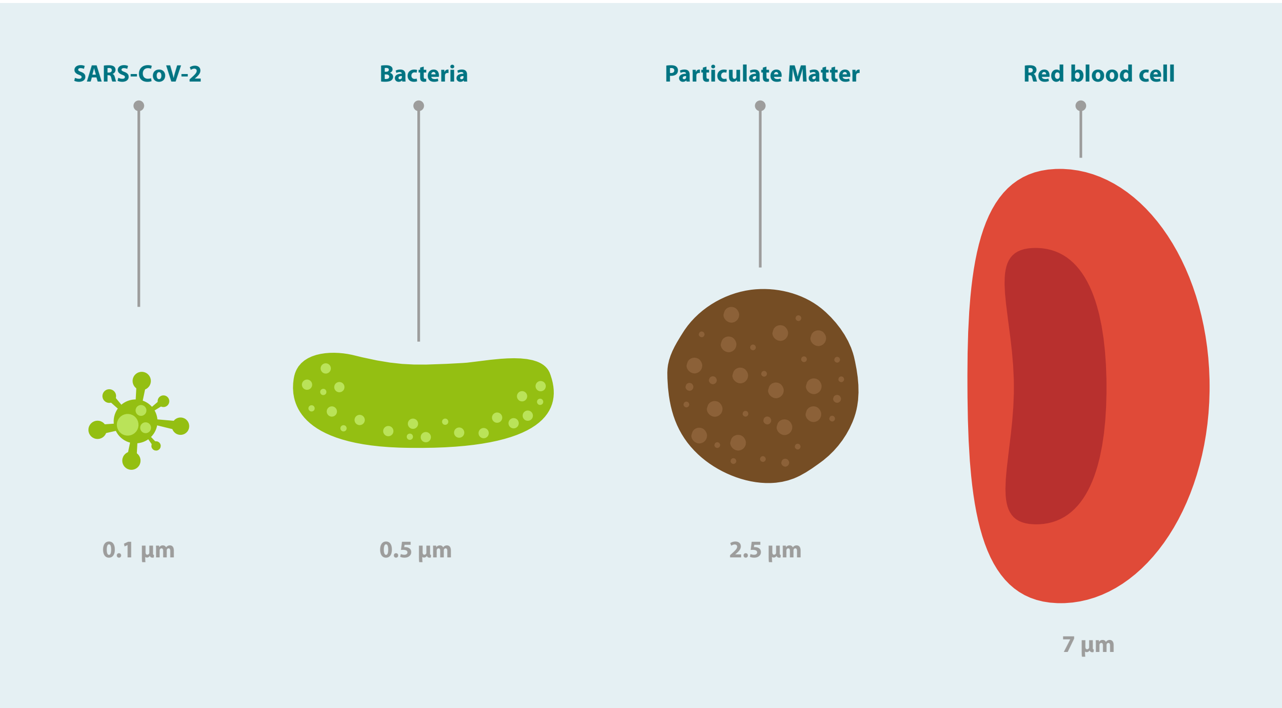
There are many different face mask types, classification standards, and raw materials used.

The purpose of face masks are to limit or prevent infection by filtering particles from air breathed in or out by the user.

The effectiveness of the face mask relates to the particle size it filters, the fit around the face, whether it can be worn for long periods of time, and how carefully it is secured or removed from one's face.

Face masks can be differentiated in terms of function: some masks are designed to limit the inhalation of virus particles (e.g. respirators), while other masks filter the breath that is exhaled by the wearer (e.g. medical masks, community masks).

Although it is difficult to capture 100% of the viruses, reducing the spread of any spray containing contaminated particles will in turn greatly reduce the amount of pathogenic content in the air.



2. WHICH MASK IS USED FOR WHICH PURPOSE?

Face mask standards can be confusing to the average user: N95, KN95, FFP2, or surgical mask? This quick overview covers mask types, mask ratings, and their effectiveness at filtering particles.

Many countries and regions have their own certification standards for each type of face mask. Europe uses the EN 14683 standard for surgical masks, whereas China uses the YY 0469 standard to represent the same mask. Each standard varies by country, however they are broadly similar. For respirators, China uses the KN standard (e.g. KN95) and the U.S. uses the N standard (e.g. N95).
Face mask types are generally categorized in medical masks (surgical masks and respirators) and community masks.

Analyzed in the meta-study from the Limbach-Group in Germany, there was no significant difference found between surgical masks and respirators N95 (FFP2) in the protective effect against respiratory viruses proven through several clinical trials. Surgical masks are therefore an adequate protective equipment.[1]

[1] Source: https://www.limbachgruppe.com/fileadmin/downloads/Arztinformationen/FuerAerzte/Checkliste_Hygiene_FFP_Masken.pdf

MEDICAL FACE MASKS

Surgical masks

Surgical masks are constructed with 3-4 layers (inner and outer coverstock and 1-2 filter layers in between) and are worn by healthcare workers while treating or examining patients.

The standard test methods measure the ability of the mask to retain bacteria (BFE-bacteria filtering efficiency). The surgical mask protects the patient from the healthcare worker and the healthcare worker is protected against droplets, splashes, or sprays of body fluids (Type IIR/Level 3 rated masks specially designed to provide splash resistance/ repellent of the outer layer as additional protection).

MASK TYPE	STANDARDS	FILTRATION EFFECTIVENESS		
Surgical Mask 	**China:** YY 0469	3.0 Microns: ≥ 95 % 0.1 Microns: ≥ 30 %		
	USA: ASTM F2100	**Level 1**	**Level 2**	**Level 3**
		3.0 Microns: ≥ 95 % 0.1 Microns: ≥ 95 %	3.0 Microns: ≥ 98 % 0.1 Microns: ≥ 98 %	3.0 Microns: ≥ 98 % 0.1 Microns: ≥ 98 %
	Europe: EN 14683	**Type I**	**Type II**	**Type IIR**
		3.0 Microns: ≥ 95 %	3.0 Microns: ≥ 98 %	3.0 Microns: ≥ 98 %

Respirators

Respirators are designed to protect the wearer from pathogens and fine particulates and are typically worn by health care workers that treat individuals that might have an infection. In contrary to surgical masks, the respirators fit tighter around the face and they can arrest up to 99% of 0.3 micron particles.

The test standards and methods for respirators also required testing of leakage and particle/dust holding capacity.

Due to the shortage of respirators with EN 149:2001 standards in Europe, NIOSH and GB2626 standards from USA and China were also approved for usage in Europe after an initial clearance by selected test institutes. The N95/KN95 filtration effectiveness can be used as FFP2 standards to arrest up to 95% of 0.3 micron particles. The N99/KN99 filtration effectiveness can be used as FFP3 standards to arrest up to 99% of 0.3 micron particles.

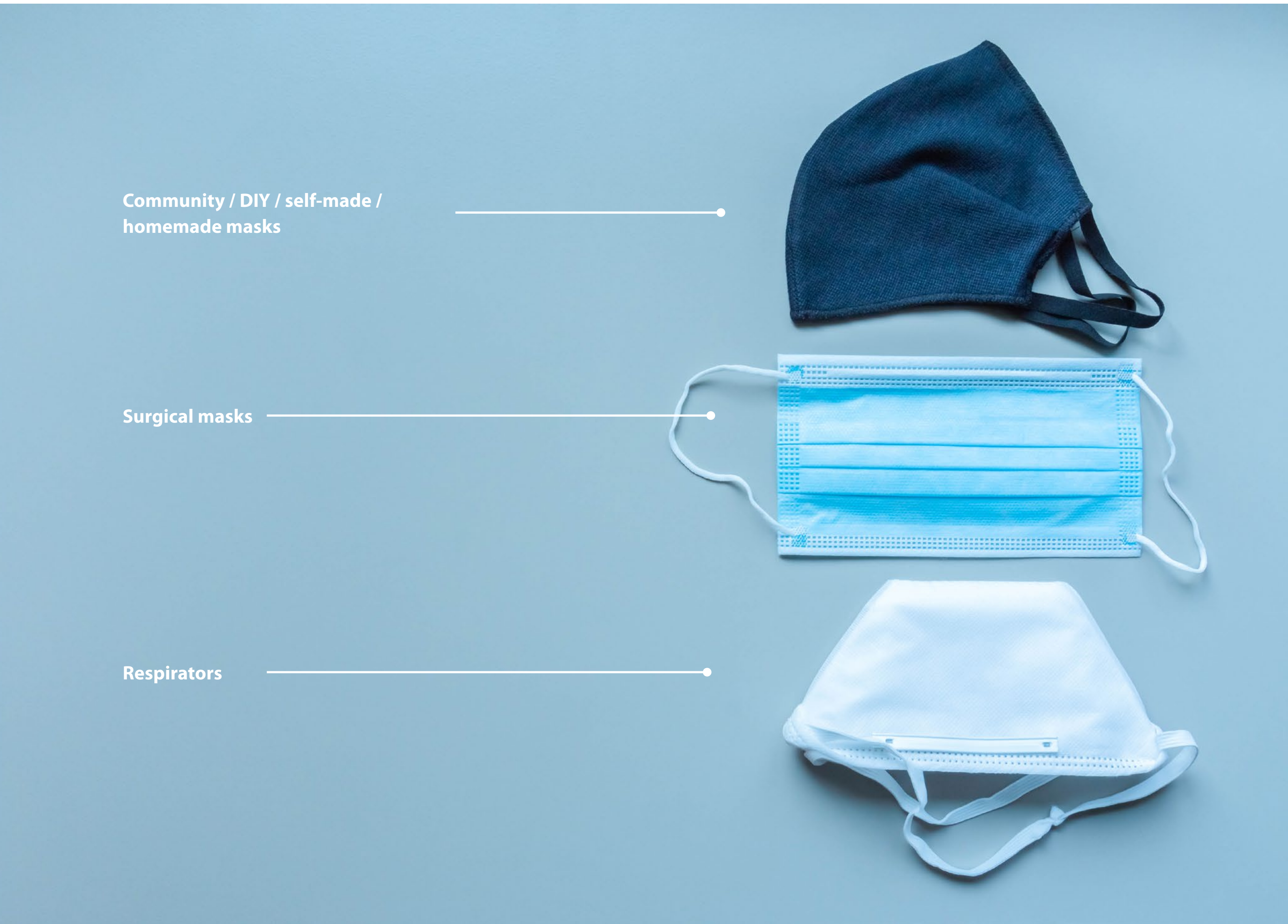
COMMUNITY FACE MASKS

Another type of face mask is the Community Mask. The intention of the community Face Mask was to limit transmission of potentially infective droplets within public spaces, with masks that are widely available, wearable by the general public and do not deplete the stocks of higher specification masks required by critical health and infrastructure workers. Depending on the country, there may also be some certification standards that need to be met, but the requirements are usually lower when compared to medical face masks.

The French Government, for example, describes a standard to categorize the community masks based on filtration efficiency. "Catégorie 1" (filtration efficiency >90%) is designed for professionals working in contact with public (e.g. bus driver), while "Catégorie 2" (filtration efficiency >70%) is suggested for all others.

Community / DIY / self-made / homemade masks:

Community face masks include various forms of self-made or commercial masks, including face covers made of cloth, other textiles, or disposable materials such as nonwovens.



3. WHICH MATERIAL IS TYPICALLY USED FOR MEDICAL AND COMMUNITY FACE MASKS?

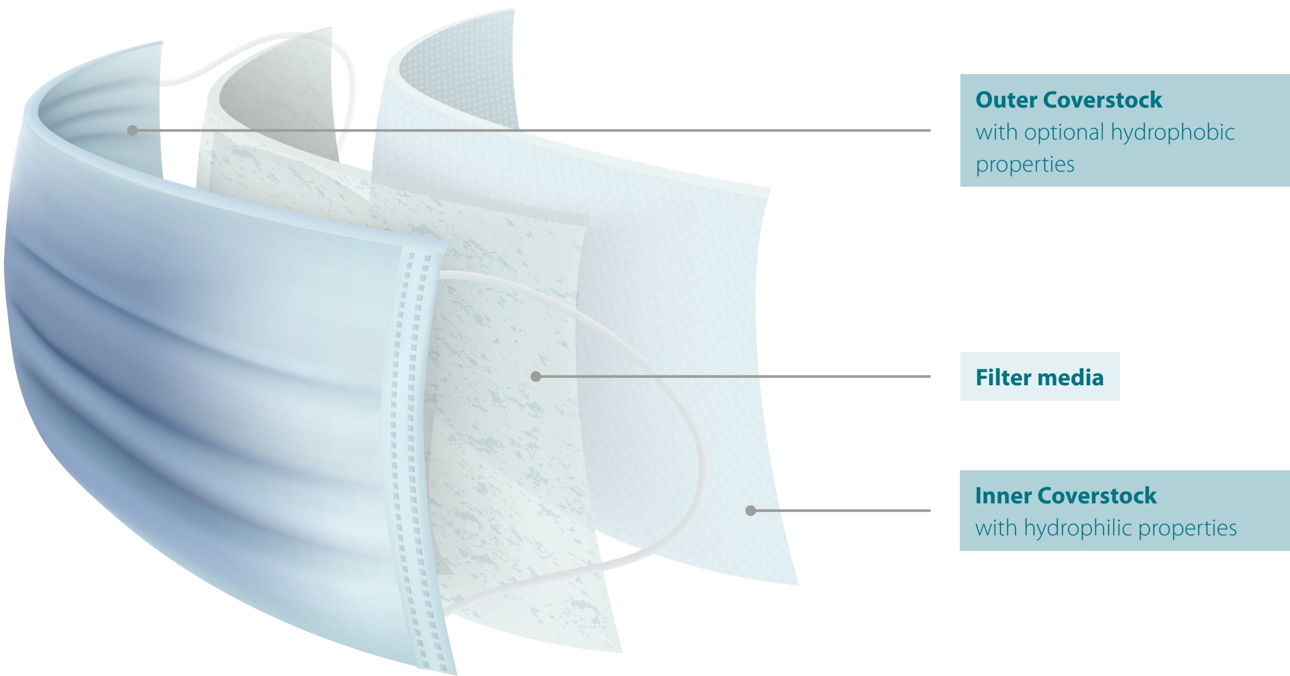
Medical face masks are often made of two layers of spunbond and one layer of meltblown nonwovens, but wetlaid and airlaid materials can also be used.

Spunbond is a material made of endless plastic fiber which are created by extruding molten plastic through very fine nozzles. This creates a web which is used to support and protect the critical inner layer of the face mask which is formed from meltblown materials.

Meltblown materials are produced by creating extremely fine fiber of molten plastic in a high temperture airstream. These fine fibers create a web containing very small pores and which is therefore able to filter out pathogens and fine particulate materials.

Spunbond, wetlaid and airlaid nonwovens are variously used for the mask outer layers and also as structural materials within the mask to support and protect the critical filter layer. In addition to protecting the filtration layer these materials can provide liquid repellency, shaping and "face-fit" of mask and contribute to the comfort and wearability of the masks. Meltblown is generally used as the key filtration layer.

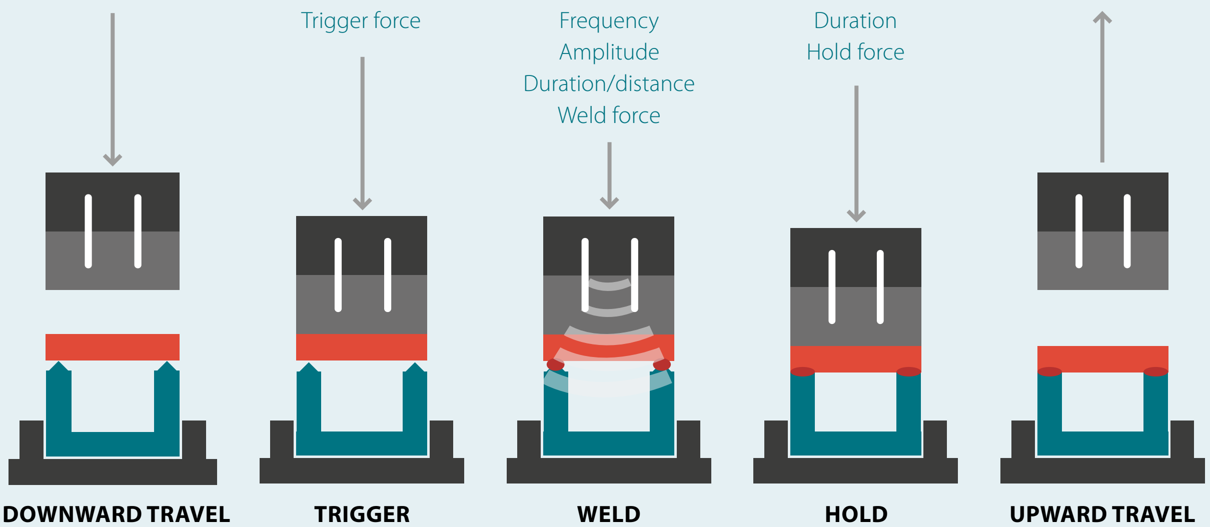
Compared to spunbond and meltblown nonwovens that are petroleum based, wetlaid nonwovens are a cellulose material. These are very soft and absorb the moisture created by breathing. Airlaid materials are also cellulose based materials which have a very open structure, absorb moisture and have excellent breath-through properties.



4. WHICH BONDING TECHNOLOGY IS USED FOR PRODUCTION OF FACE MASKS?

There are different bonding technologies used in the face mask production. The most often used technology in a face mask production line is ultrasonic welding. During the ultrasonic weld process, mechanical vibrations of an ultrasonic frequency at a specific amplitude, force and duration are transferred into the materials to be welded. The ultrasonic energy creates molecular and boundary layer friction within the material, and this in turn generates heat causing the material to melt. Material for welding must have thermoplastic properties (e.g. the material includes polypropylene-based fibers).

WELDING PROCESS FLOW



Another current technology for bonding is heat sealing. During the heat-sealing process, a permanent heated sealing tool melts the material to be welded, at a specific sealing dwell time, temperature, and pressure. This technology also requires thermoplastic fibers/material to be present.

A third application process is sewing, which is often required to attach the ear loops or head straps to the masks.

For the sake of completeness, laser welding is another welding process but is rarely used.
Finally, it should be noted that the overall quality of the bonding depends on the actual design of the face mask, especially the arrangement of the different layers and the realization of the folds. The way the ear loops are integrated should also be considered. Due to the great variety of face masks that are on the market, this needs to be clarified on a customer-specific and application basis.

5. GLATFELTER'S OFFERING

Glatfelter is a leading global supplier of engineered materials with extensive experience in providing solutions for medical applications such as face masks, wound care, and diagnostic strips.

Our Wetlaid grades Dynaweb 2015S, Dynaweb 2017S and Dynaweb 2019 can be used in product construction for medical face masks, as well as community masks. The grades are available in white, blue, and green, and offer a much more comfortable feeling for coverstock applications compared to the commonly used spunbond materials.

Spunbond is a 100% synthetic fiber-based material, while our Wetlaid is primarily a cellulose-based material. As such, it will be softer for the skin and better absorb the humidity created by breathing. This is important, particularly if people are wearing the mask over a long time.

These grades are tested and certified to be used as coverstock material for face masks (certificates available for cytotoxicity – skin irritation – skin sensitization).
If the final product is intended to be used as a community face mask, and not by health care workers, Glatfelter can also provide a grade to be used as a filter layer for non-medical applications.

Using our extensive engineered materials experience and in cooperation with several finished goods producers and converters, Glatfelter can advise on individual bonding processes and material combinations that may be suitable for your needs.

Read more at:
www.glatfelter.com/solutions/segments/medical/face-masks/

IN CONCLUSION

There are many different mask designs and materials available that deliver a range of performance. We hope this document has been helpful in providing a better understanding of face masks and in clarifying the actions and choices that may arise when developing face mask products.

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