CARES Act Project

INCREASING MASK SUPPLIES TO FIGHT THE SPREAD OF COVID-19

PRODUCTION OF N95 AND SURGICAL MASKS AT THE NONWOVENS INSTITUTE (NWI), NORTH CAROLINA STATE UNIVERSITY

NIIMBL® The National Institute for Innovation in Manufacturing Biopharmaceuticals

North Carolina State University Nonwovens Institute

Type:
Academic Research Institution

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INDUSTRY NEED

At the start of the pandemic in 2020, the U.S. did not have the capacity to produce masks and respirators with adequate filtration technology to meet the needs of healthcare workers and the community. Typically, surgical masks and N95 respirators are made with a nonwoven fabric called meltblown because it offers high filtration capabilities. However, meltblown was already being produced at maximum capacity and the lead time to get a new meltblown machine up and running could take nearly 18 months, thus limiting the nation's ability to supply proper protective masks.

SOLUTION

To increase capacity for producing masks, the Nonwovens Institute at North Carolina State University set out to maximize the filtering performance of an alternative nonwoven fabric called spunbond that can be produced more quickly than meltblown. With its strong structure, spunbond is typically used as a protective layer over the more fragile meltblown. Spunbond fibers are 15 microns or larger and provides less filtration capabilities than meltblown, which has one micron or submicron fibers. However, it is unique in that it allows for two different polymers to be combined into a single fiber called a bicomponent fiber. The team aimed to explore the bicomponent technology to create fibers that are 1 micron or less and increase the filtering capabilities. Spunbond has a 4-5x higher throughput than meltblown, meaning more masks can be produced quickly to help ease supply constraints.

OUTCOME

Within approximately 90 days, the team developed a single layer spunbond media with 92% filtration efficacy and low breathing resistance, suitable for community masks. The team found two spunbond layers increased the filtering efficiency to 99%. For comparison, typical respirators are six layers and achieve the same 99% filtration efficiency. The spunbond mask created at the NWI is the only in the world to reach this filtration efficiency. These enhancements to the spunbond technology opened doors to increased mask production. The technology earned the NWI the Association of Nonwovens Fabrics Industry RISE Award. As of fall 2021, the Nonwovens Institute has produced more than 12 million meters of spunbund which equates to approximately 200 million masks. The masks have been distributed throughout the North Carolina State University community. It has also partnered with several organizations to make masks available through local and national retailers. Since completing its NIIMBL-funded work, the team has worked with the Department of Defense to create a respirator for the warfighter that combines the spunbond and meltbond technologies.

> *"The funding allowed us to run a lot of different experiments and combinations to fine tune the filter and make it better. Without the funding, we wouldn't have been able to offer as much as we did to the community to test these new ideas and run refinements on the product."*

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