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Observations Regarding Commonly Available Materials for Face Covering Emulated-Personal Protective Equipment

The Center for Disease Control has recommended that to reduce potential exposure to COVID-19 the public should wear cloth face coverings in public settings where other social distancing measures are difficult to maintain[1]. These face coverings and other Emulated-Personal Protective Equipment (E-PPE) can be made by using Commonly Available Materials (CAMs). As E-PPE recommendations continue to flood the media, a Sandia COVID-19 LDRD effort, the Sandia E-PiPEline Team, systematically evaluated E-PPE design options considering their effectiveness, durability, build difficulty, build cost, and comfort. Using qualitative and semi-quantitative evaluation tools, results of the investigation are presented here to provide guidelines for home and office construction of E-PPE.

DESIGN SPACE

The principle design characteristics and alternatives considered for the construction of an E-PPE face covering are listed below.

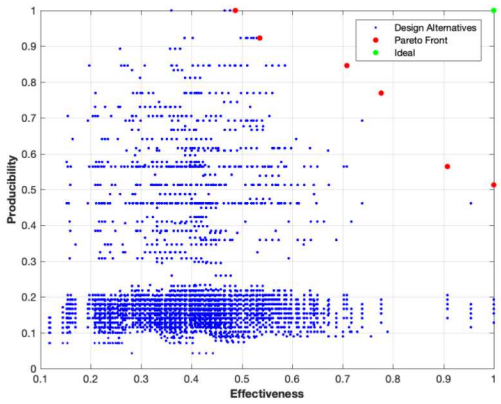
Number and materials of material layers: 1-3 layers, woven cotton materials, paper-based materials, synthetic fabrics

Connection method and location between layers: sewn, glued, stapled

Treatments of the top layer: machine wash, bake in oven, iron, machine dry

Attachment methods: integrated designs, compression straps, Velcro straps

The graphic at top illustrates the scores of the more than 200,000 designs evaluated for face coverings using CAMs. The normalized design scores are shown in blue, with the best options shown in red.

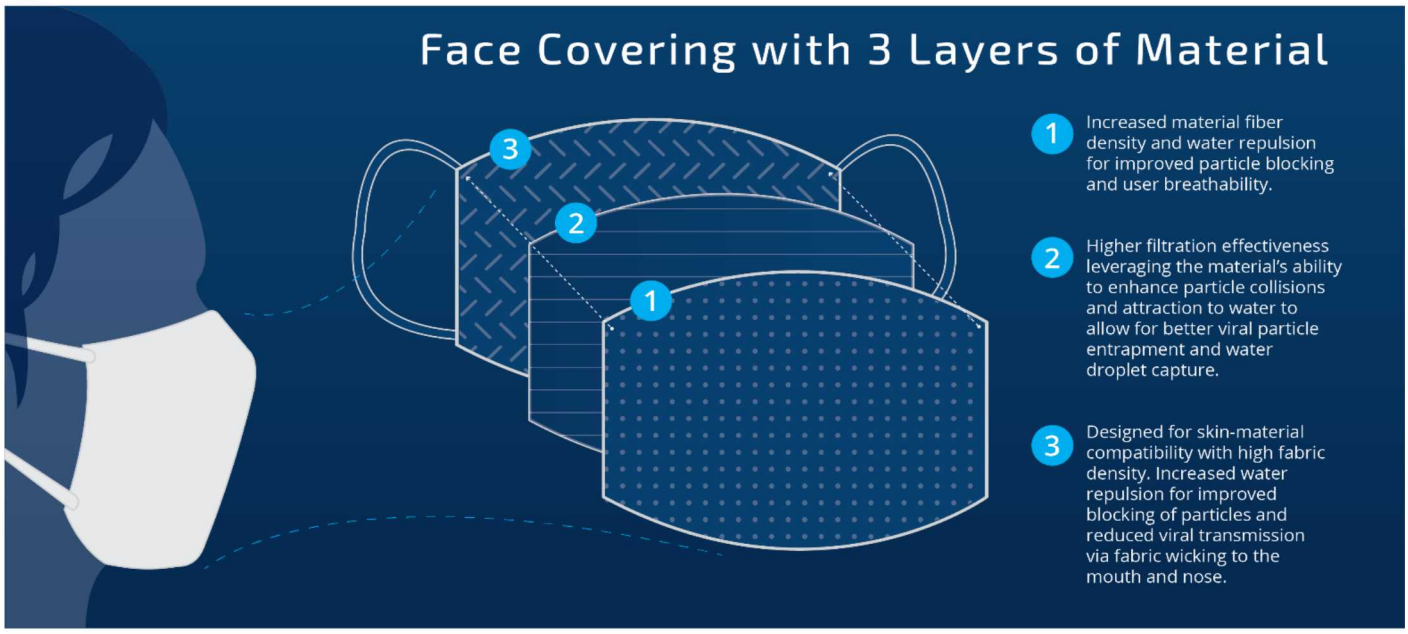


MATERIAL OBSERVATIONS

- Leverage cotton and paper-based materials to capture aerosolized water droplets within the fiber matrix
- The material placement of natural-based materials sandwiched between two water repelling synthetic based materials decreasing the probability of viral transmission by decreasing liquid movement towards the face
- Select materials with high fabric density to improve particle filtration while maintaining user breathability
- Prioritize user safety by selecting materials that reduce loose material particle inhalation hazards

DESIGN OBSERVATIONS

- Full coverage over mouth and nose reduces chance of viral transmission
- Mask conformability improves filtration effectiveness



[1] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html

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