Observations Regarding Face Shield Designs Using Commonly Available Materials

Sandia National Laboratories

A Sandia COVID-19 LDRD effort, the Sandia E-PiPEline Team, systematically evaluated design options for face shields constructed from commonly available materials (CAMs). This study is not focused on face shields for medical applications, and as such, has excluded labeling and flammability considerations suggested by the FDA. Design options for face shields were analyzed with subject matter expert input considering the design's **effectiveness** (seal around face), **reusability** (compatibility with solvents, degree of inertness), **producibility** (ability to obtain materials, build time), **cost**, and **comfort** (fit around head, contact surface interface). Observations for the design of face shields using CAMS are provided here.
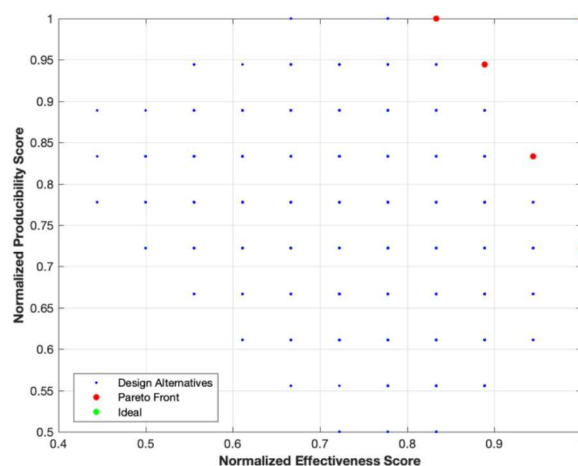

DESIGN SPACE

The principle design variables considered for the construction of a face shield were:

Primary shield material: polyethylene, polypropylene, cellulose acetate

Structural material: foams, safety glasses, cardboard, wood

Attachment methods: sewn, glued, stapled

The graphic at top illustrates the results of scoring more than 900 designs evaluated for face shields using CAMs. The normalized design scores are shown in blue, with the best options shown in red. The scores are normalized relative to the highest score in the **effectiveness** and **producibility** metrics.

DESIGN OBSERVATIONS

- Minimizing the gap between the face shield and the forehead will help reduce the chance of liquid splash to the eyes
- It is important that the face shield extends down below the chin and stretch around the full-face area
- Designs that use compression to attach the face shield to the face were observed to be promising

MATERIAL OBSERVATIONS

- Using foam as the primary frame/face interface material provides splash protection
- For reuse of the face shield, choosing materials that are compatible with common solvents, like polypropylene

Face Shield using Foam as the Primary Structure

1 Foam interface to allow for comfortable seal

Maximized frame/skin interface surface area to provide enhanced splash protection

2 Full face protection with extended facepiece length to provide protection from both front and side splash events

Designed for multiple reuse options by leveraging material properties for improved compatibility with known disinfectants.