Additive Manufacturing of Smart Material and Complex Structures

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Abstract

Additive Manufacturing (AM), typical referred as rapid prototyping or three-dimensional (3D) printing has rapidly emerged as a sustainable, high efficient and intelligent tool. Moreover, recent developments in novel materials and software tools have synergistically expanded the stage for additive manufacturing. Here we present the fabricated 3D printed objects for application in biomedical, sensor, gas filter and fluid flow controllers. The fabricated CO_2 gas sensor exhibited the sensitivity of as low as 10 ppm and offered high selectivity towards other gases.

Keywords: 3D printing, Self sanitizing glove, Mask, Gas filter, CO_2 sensor

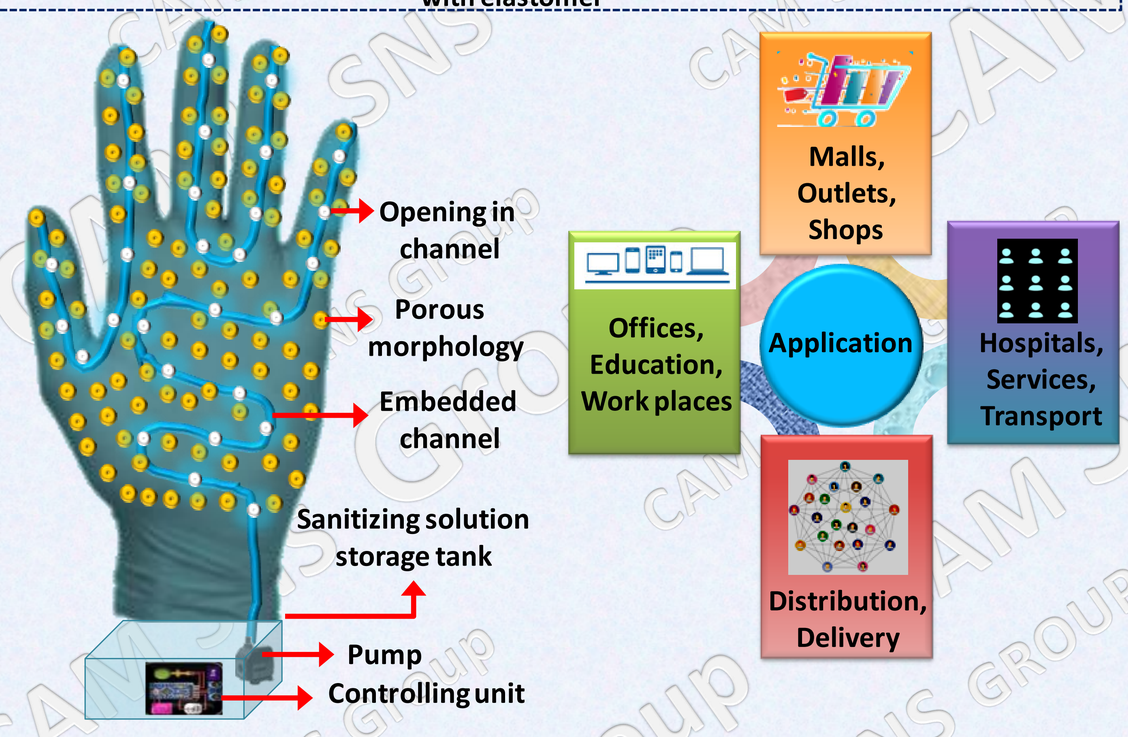
Types of 3D Printing

- Stereolithography (SLA)
- Selective Laser Sintering (SLS)
- Fused Deposition Modeling (FDM)
- Digital Light Process (DLP)
- Multi Jet Fusion (MJF)
- PolyJet
- Direct Metal Laser Sintering (DMLS)

Advantages

- Flexible Design
- Rapid Prototyping
- Print on Demand
- Lightweight Parts
- Fast Design and Production
- Minimizing Waste
- Cost Effective

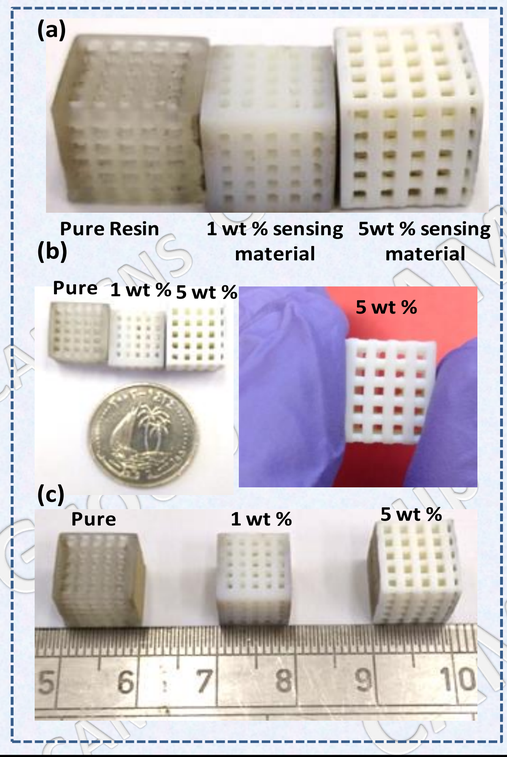
3D Printing Assisted Self Sanitizing Gloves

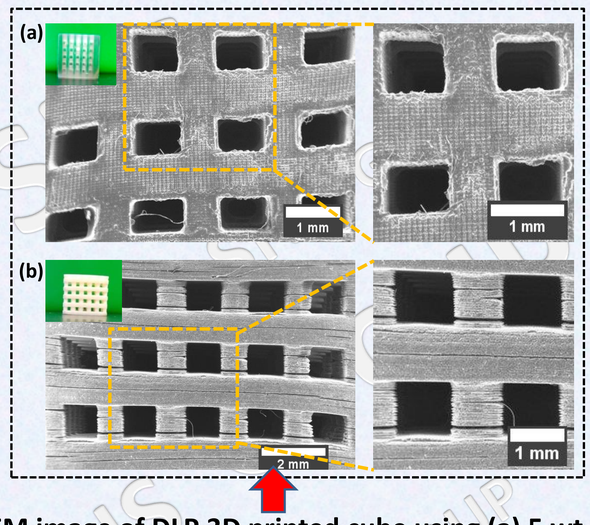


3D printed Mask

- Low processing cost.
- Significantly reduces the time for bulk production.
- Require less manpower.

3D Printed Channelled Cube for CO_2 Gas Absorption

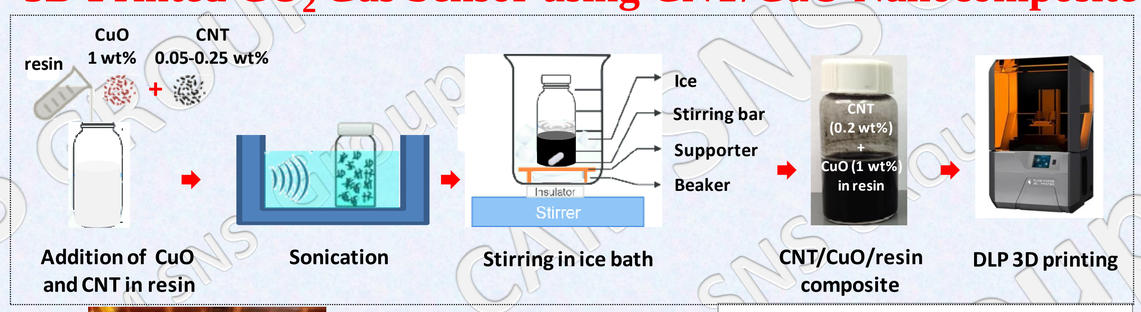


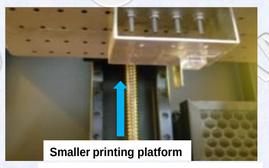


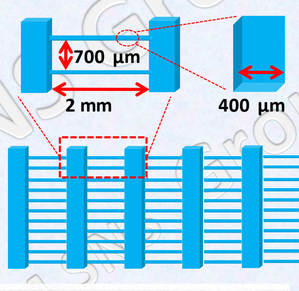
SEM image of DLP 3D printed cube using (a) 5 wt % sensing material mixed resin. (b) Pure resin.

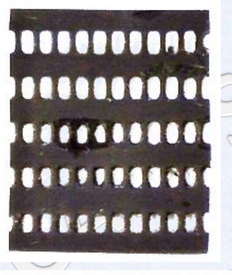
DLP 3D printed porous cube by varying weight percent of the sensing material. (b) Showing through holes in the cube. (c) Size representation.

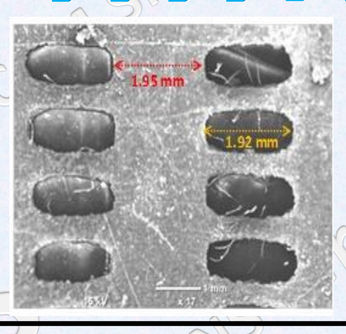
3D Printed CO_2 Gas Sensor using CNT/CuO Nanocomposite

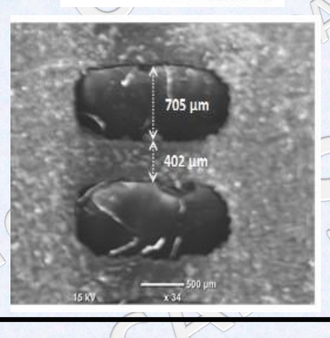


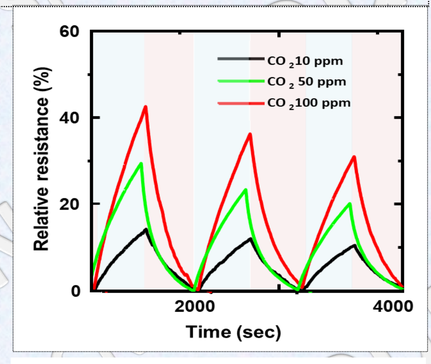


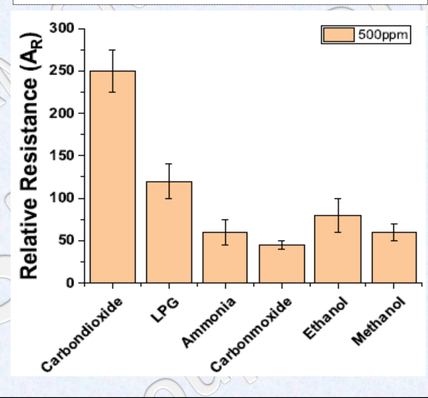




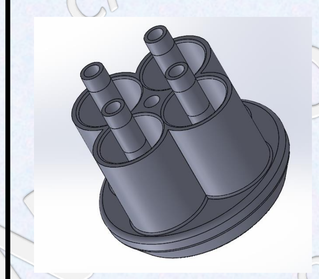






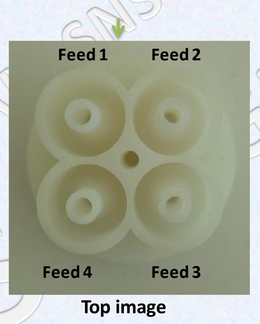


3D printed Structures for Controlled Pumping of Fluid

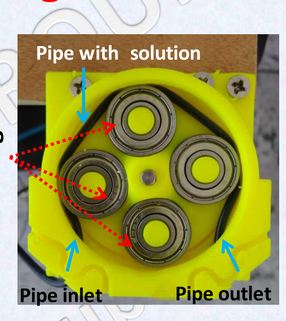


CAD design of 4 to 1feed connector

Bottom Image



Top image



Conclusion

- Additive manufacturing can be used in various fields like, sensors, biomedical and designing complex structure.
- Require negligible manpower and offers high reproducibility, repeatability and accuracy.

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