Specifications of selective ultrasonic spraying system

1. Complete ultrasonic selective spraying system shall be easily integrated with existing filament winder equipment and 3-D printer.
2. The spraying system shall be composed of two different types of ultrasonic nozzles with spray shaping assembly, control enclosure, and pressurized liquid delivery system.
3. Both ultrasonic nozzles shall be feasible to the ultrasonic spraying system.
4. The liquid delivery system shall have an ultrasonic syringe to make uniform dispersion solutions including nanoparticles, carbon nanotubes, graphene, etc.
5. The liquid delivery system shall have the ability for programmed ultrasonic vibration duration and intensity for less than 10 mls of liquid solution and shall be easy to configure with the ultrasonic spraying system.
6. The liquid delivery rate of the liquid delivery system shall range from 0.1 ~ 30 ml/min.
7. The ultrasonic syringe in the liquid delivery system shall have at least 25 ml capacity.
8. Both ultrasonic nozzles shall have self-cleaning capability to prevent clogging.
9. First ultrasonic nozzle of specifications shall be as follows:
    a. The spray pattern diameter shall be reducible to 0.3 mm.
    b. The flow rate shall range from at least 0.5 ~ 9 ml/hr.
    c. The operating temperature shall be up to 150 ^{o}C.
    d. The air pressure shall range between 0 and 2 psi.
    e. Multiple solution delivery shall require only one ultrasonic nozzle.
10. Second ultrasonic nozzle of specifications shall be as follows:
    a. The spray pattern diameter shall range from 2 to 6 mm.
    b. The flow rate shall range from at least 1 ~ 100 ml/hr.
    c. The operating temperature shall be up to 150 ^{o}C.
    d. The system shall include an ultrasonic nozzle that can spray at any angle.
    e. The air pressure shall range between 0 and 2 psi.
11. The pressured gas requirement shall be compressed dry air or gas, 15-150 psi.
12. The power requirement shall be 110 V, 60 Hz single phase.
13. The complete spraying system shall be programmable for spray sequences by precise on/off triggering.
14. The system shall include a control module that has an external trigger input switch and alarm output for nozzle malfunction.