

# AEROSOL JET<sup>®</sup>

## MATERIALS FAQs



Materials for Aerosol Jet printing

Aerosol Jet systems have the unique ability to directly print a wide range of electronic and biological materials onto almost any substrate. The Aerosol Jet deposition process supports a broad range of commercially available materials, as well as custom formulations.

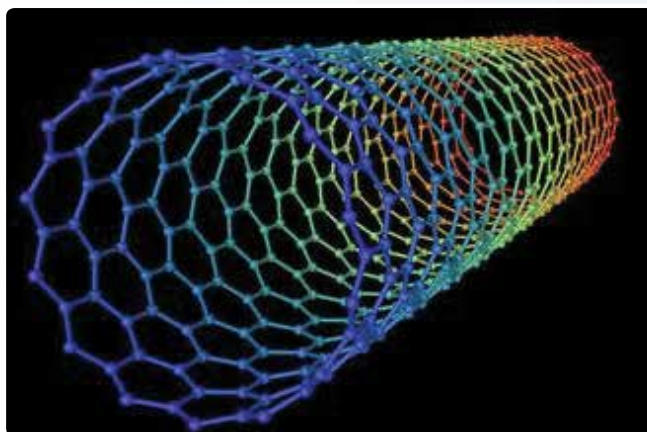
## Min/Max Printable Feature Sizes for Aerosol Jet Systems

### MINIMUM FEATURE SIZE IS MATERIAL DEPENDENT:

- ▶ ~10  $\mu\text{m}$  features consistently printed on SiO<sub>2</sub>
- ▶ Pitch between lines can be ~20  $\mu\text{m}$

### MAXIMUM FEATURE SIZES ARE USER CONTROLLABLE

- ▶ 3 mm or greater using a wide nozzle print head
- ▶ With multiple passes, features sizes are limited to the size of the underlying substrate



Carbon Nanotube

### TYPICAL PARTICULATE BASED INKS FOR AEROSOL JET SYSTEMS:

#### SOLVENTS:

- ▶ High boiling point / low vapor pressure (compare to ethylene glycol)

#### PARTICLES:

- ▶ Size: 300 - 500 nanometers maximum ; < 200 nanometers preferred
- ▶ Solids content: 5 - 70 wt%
- ▶ Multiple solid components, if used (e.g. silver and glass frit) should be equally dispersed throughout ink

#### RHEOLOGY

- ▶ Viscosity: 1.0-1,000 cP at ambient temperature, or by heating the ink (ink dependent)
- ▶ Shear behavior: shear thinning or Newtonian – preferred; shear thickening -unacceptable

### MATERIALS

#### SUPPORTED MATERIALS:

- ▶ Pure liquids or solvents
- ▶ Solutions
- ▶ Dispersions
- ▶ See next page for Aerosol Jet printed material listings

## Aerosol Jet Systems Material/Substrate Matrix

METAL INKS	RESISTOR INKS	NON-METALLIC CONDUCTORS
An Cuig (Pt) Applied Nanotech (Ag, Cu, Ni, and Al) Clariant (Ag) Dupont (Ag) Henkel (Ag) Intrinsic (Cu) Paru (Ag) Nova-Centrix (Ag and Cu) Resin Designs (AgE) UT Dots (Au, Ag, Pt) Sun Chemical (Ag) Xerox (Ag)	Acheson (carbon) Asahi (carbon) Dupont (carbon and ruthenate) Lord (carbon) Methode Development (carbon)	Brewer Science (SWCNTs) Heraeus (PEDOT:PSS) NanoIntegris (SWCNTs and MWCNTs) SouthWest Nanotechnologies (SWCNTs and MWCNTs)
DIELECTRICS AND ADHESIVE	SEMICONDUCTORS	REACTIVE CHEMISTRIES, RESISTS, AND ETCHANTS
Aldrich (polyimide) BASF (PVP) Dupont (Teflon AF) Gersteltec (SU-8) Henkel (adhesives) Loctite (adhesives) Mantech Materials (polyimide) Microchem (SU-8) Nazdar (opaque coating fluids) Norland (UV adhesives) Summers Optical (UV adhesive) Sun Chemical (UV acrylics)	Aldrich (organic semiconductors) Alfa (organic semiconductors) Brewer Science (SWCNTs) Cheap Tubes (SWCNTs) Merck (organic semiconductors) NanoIntegris (SWCNTs) Southwest Nanotechnologies (SWCNTs)	Aldrich (general solvents, acids, and bases) Alfa (general solvents, acids, and bases) Rohm & Hass Shipley (photo and etch resists)

### ABOUT OPTOMECH

Optomec® is the world leading provider of additive manufacturing systems for high-performance applications in the Electronics, Biomedical, Photovoltaic, and Aerospace & Defense markets. These systems utilize Optomec's patented Aerosol Jet Printed Electronics technology and LENS powder-metal fabrication technology.