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## **A Review on Nano-Fiber Fabrication Methods by Near-Field Electrospinning**

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## *Abstract*

Faculty: Nanotechnology

School of Engineering and Sciences

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**keywords:** nanotechnology, nano-fiber, near-field electrospinning, NFES

# 1 Summary

TABLE 1.1: Electrospun Polymer Solutions - Solution and Process Parameters

Polymer	Solvent	NFES Variant	Polymer Solution and Process Properties	Fiber Characterization	Reference
Poly(ethylene oxide) (PEO)	Deionized water	Mechano electrospinning	<ul style="list-style-type: none"> <li>• PEO Concentration: 1, 2, and 3 <i>wt%</i></li> <li>• Rise in solution conductivity with the increase in PEO concentration</li> <li>• Solution Stirring: 24 <i>h</i> of free diffusion followed by 96 <i>h</i> of stirring at 30 <i>rpm</i></li> <li>• 3 <i>mL</i> syringe</li> <li>• 27 gauge type 304 stainless steel needle</li> <li>• Solution deposition rate: lower than 1 <math>\mu\text{L}/\text{h}</math></li> <li>• needle-to-collector distance: 1 <i>mm</i></li> <li>• Collector substrate: Pyrolyzed SU-8 carbon and Si</li> </ul>	<ul style="list-style-type: none"> <li>• Diameter: 50-425 <i>nm</i></li> </ul>	[1]

TABLE 1.2: Electrospun Polymer Solutions - Solution and Process Parameters

Polymer	Solvent	NFES Variant	Polymer Solution and Process Properties	Fiber Characterization	Reference
			<ul style="list-style-type: none"> <li>• NFES process initiated by an air interference with a glass microprobe tip (1 to 3 <math>\mu m</math> tip diameter) to overcome the surface tension</li> <li>• Time to produce a stable continuous jet: 45 min</li> <li>• Polymer jet initiated at 400-600 V and dispensed at 200-400 V</li> <li>• Collector linear speed: 10-40 mm/s</li> <li>• The voltage turned on when the solution formed a full-sized droplet of 500 <math>\mu m</math> diameter at the needle tip.</li> </ul>		[1]
Poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] (MEH-PPV) with Poly(ethylene oxide) (PEO)	acetonitrile / toluene mixture (65 / 35); acetic acid / toluene (17 / 83); pure toluene	Mechano electrospinning	<ul style="list-style-type: none"> <li>• Concentrations: <ul style="list-style-type: none"> <li>– MEH-PPV solution: 10 mg of MEH-PPV in 2 mL of toluene</li> <li>– 500 <math>\mu L</math> of MEH-PPV solution with 250 mg of PEO in 3.5 mL of acetonitrile / toluene (65 / 35)</li> <li>– 500 <math>\mu L</math> of MEH-PPV solution with 250 mg of PEO in 3 mL of acetic acid / toluene (17 / 83)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Distance between adjacent fibers: around 100 <math>\mu m</math></li> <li>• Fiber diameter: around 100 nm</li> </ul>	[2]

TABLE 1.3: Electrospun Polymer Solutions - Solution and Process Parameters

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- The resulting MEH-PPV/PEO concentration is 1:100
  - Solution Stirring:
    - MEH-PPV solution stirred for 4 *h*
    - PEO solution stirred for 8 *h*
    - MEH-PPV/PEO solution stirred and ultrasonically agitated
  - Collector substrate: SiO<sub>2</sub>/Si (oxide thickness = 800 *nm*)
  - needle-to-collector distance: 500 *μm*
  - *μm*-diameter tip Tungsten spinneret in a 26 gauge needle
  - Solution deposition rate: 50 *μL/h*
  - Electrostatic voltage: around 1.3 *kV*
  - x-y stage velocity: 50 *cm/s*
- 

[2]

TABLE 1.4: Electrospun Polymer Solutions - Solution and Process Parameters

Polymer	Solvent	NFES Variant	Polymer Solution and Process Properties	Fiber Characterization	Reference
					[3]
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					[5]
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