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Electrospinning

Research training
at
IPPT PAN
June/July 2009

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Outline

- Viscosity measurements
- Image analysis
- Bubble electrospinning
- Double nozzle electrospinning

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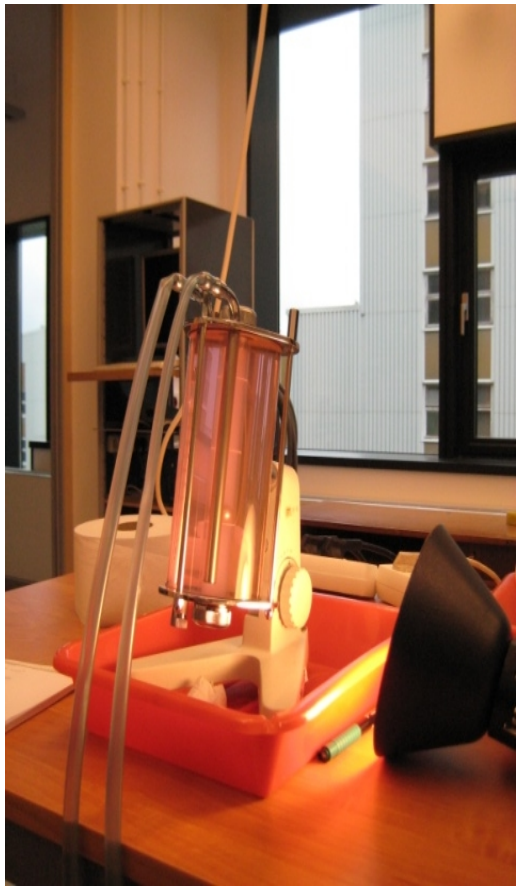
Viscosity measurements

- Done with a Hoebbler, or ”falling ball” viscometer

- $\eta = t(\rho 1 - \rho 2)KF$



η = dynamic viscosity

t = the measured time
ρ1 = ball density
ρ2 = liquid density
K = ball constant,
F = angle multiplicator

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Image analysis

- Samples with four different glycerol concentrations were spun
  - Approx. 72, 67, 62 and 53.7 wt%
  - Contained 3% PEO solution at 1/3 of the wt% of the glycerol
- Recordings (thousands of pictures…)
- Main variable: voltage

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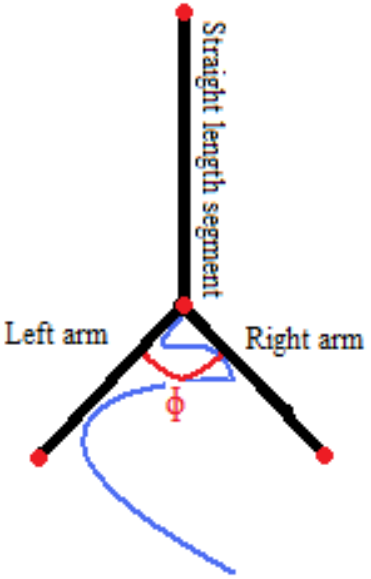
Image analysis

- Four measuring points
- Calculations were made for the length of the:
  - straight segment
  - left cone arm
  - right cone arm
  - angle between left and right arm



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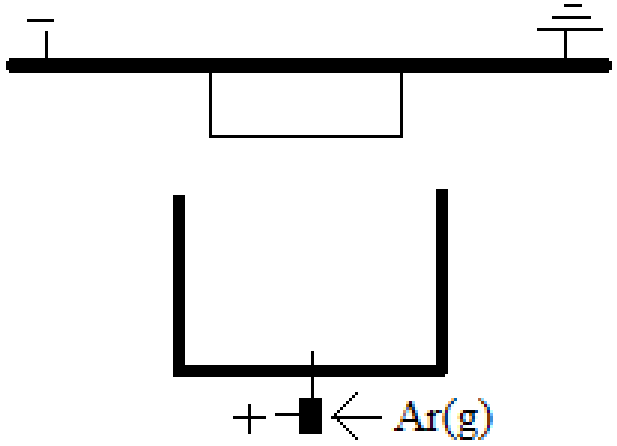
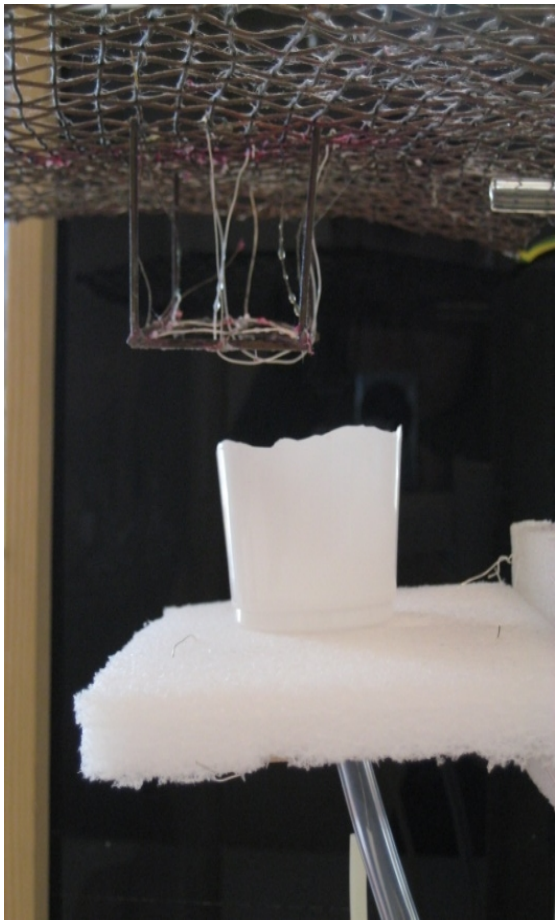
Bubble electrospinning

- 3 plastic cups, 25, 40 & 55 mm in height
- Upside down spinning
- 3wt% PEO water solution





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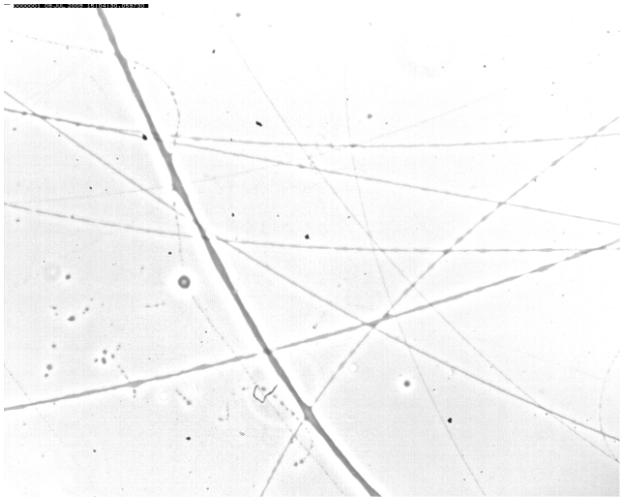
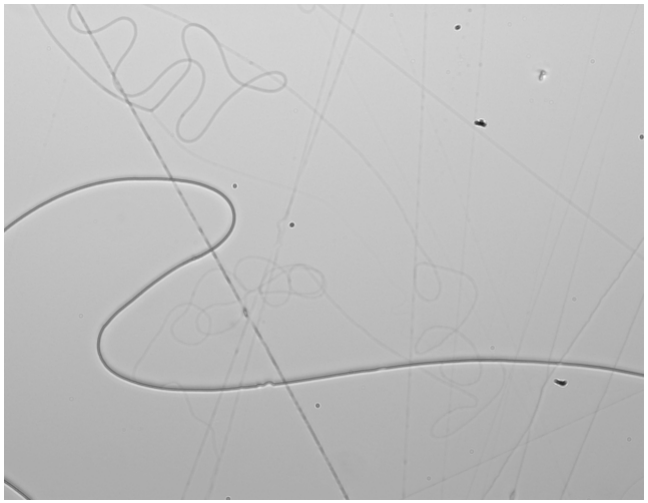
Bubble electrospinning - Results



Fibers spun in bubble spinning setup at 20 kV with 40 mm cup.
Distance 80 mm, 20x magnification.
True size of picture (h x w) 331 x 414 µm.



Fibers spun in ordinary spinner setup.
12 kV, pump speed 400 µl/h.
Distance 100 mm. 20x magnification.
True size of picture (h x w) 331 x 427 µm.

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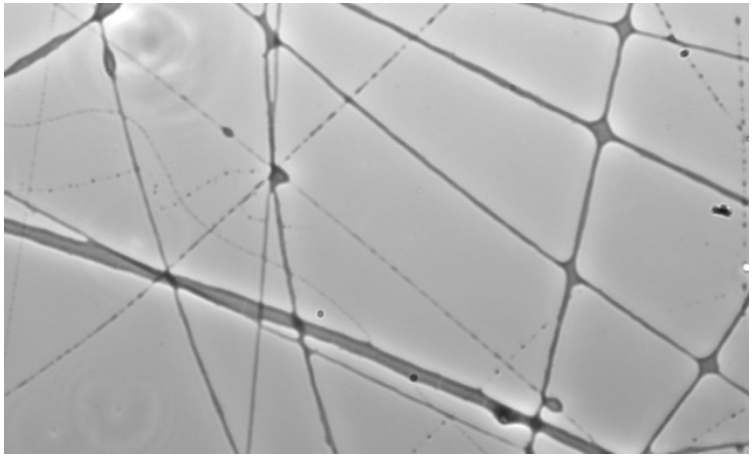
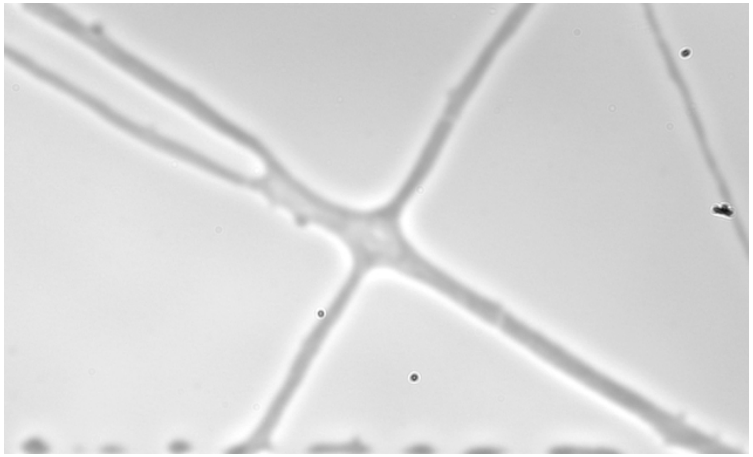
Bubble electrospinning - Results



Fibers spun in bubble spinning setup at 20 kV in with 25 mm cup. Distance 90 mm, 20x magnification.
True size of picture (h x w) 183 x 304 µm.



Fibers spun in bubble spinning setup at 20 kV in with 25 mm cup.
Distance 90 mm, 100x magnification.
True size of picture (h x w) 97 x 138 µm.

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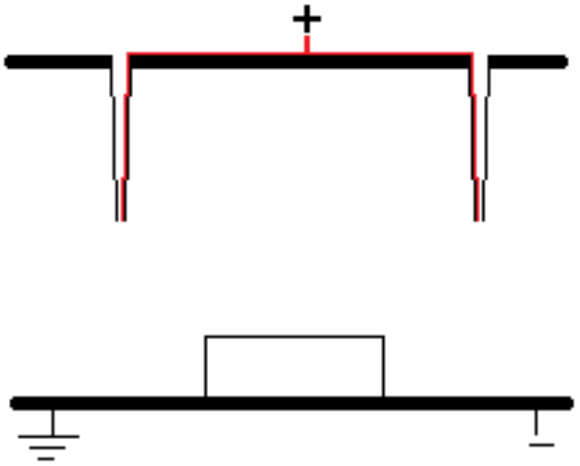
Double jet

- 2 nozzles
- Three distances 50, 75 & 100 mm between nozzles
- 2 distances to target



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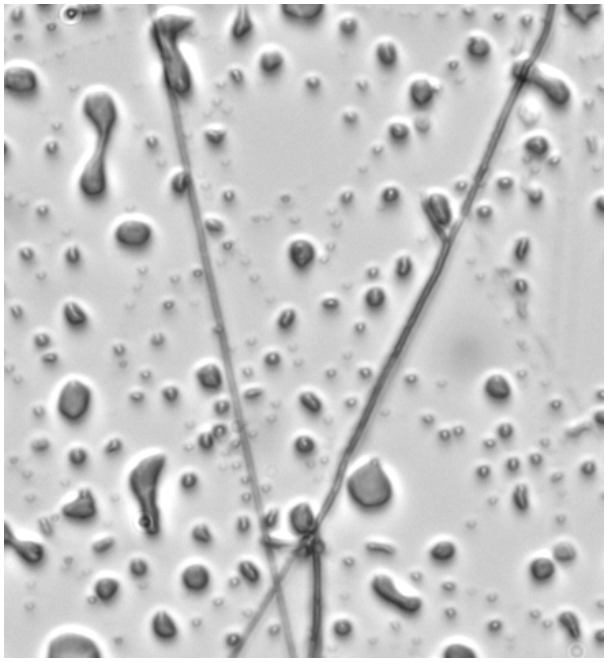
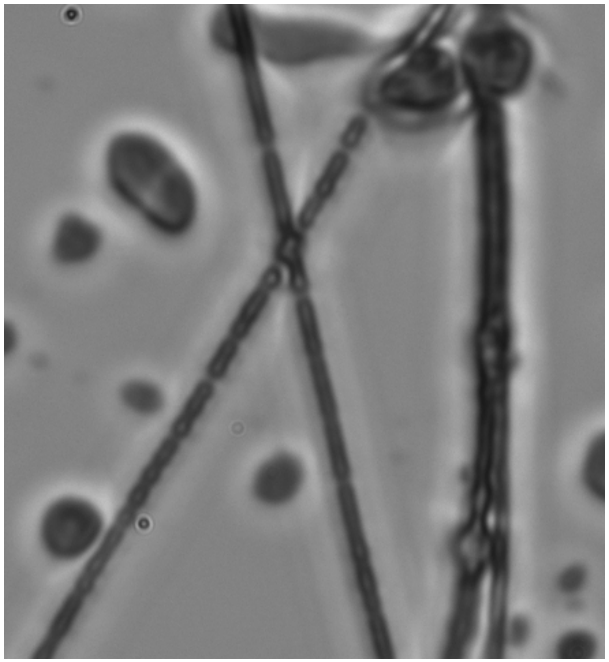
Double jet - results



20x magnification
Fibers formed 18 kV, 10 cm from target.
Nozzle distance: 75 mm
True width of picture: 144 µm.



100x magnification
Fibers formed 18 kV, 10 cm from target.
Nozzle distance: 75 mm
True width of picture: 144 µm.

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Double jet - results

Distance between nozzles	Angle
50 mm	23°
75 mm	20°
100 mm	26°

Showing the angle between the straight segments with two nozzles spinning.

Single nozzle	5°
50 mm	15°
75 mm	17°
100 mm	18°

Showing the angle of inclination for the straight segment with only one nozzle, or with only one of the two nozzles running.

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Thank you for listening!