On electrochemical actuation of Carbon Nanotube Yarns

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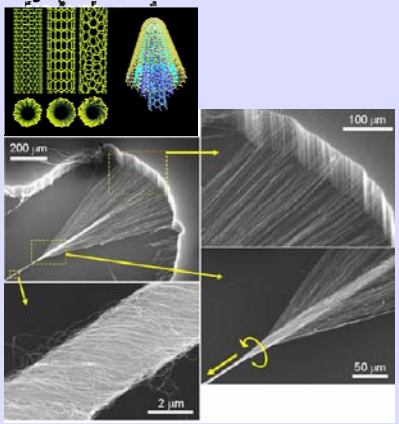
• **Aim:** To characterize the electrochemical actuation properties of Carbon Nanotube Yarns

•Synthesis:

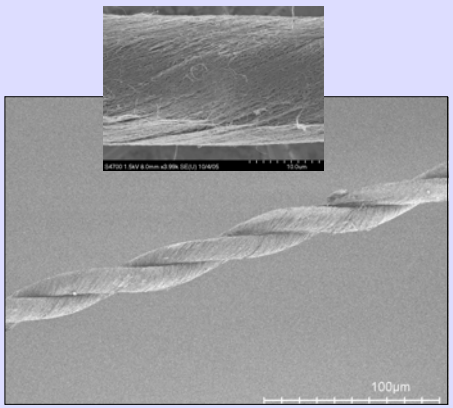


• Forest of multiwall nanotubes (MWNT):
  • MWNT length=~50µm
  • diameter = 10-15nm

•Yarn spun by picking up MWNTs using a sharp needle and spinning it as it is slid slowly across the forest surface[1].

•Yarn diameter 8-18 um.

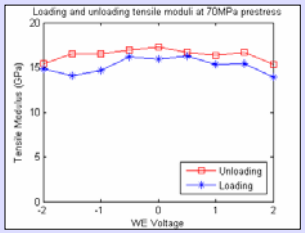
•Yarn length as long as desired.



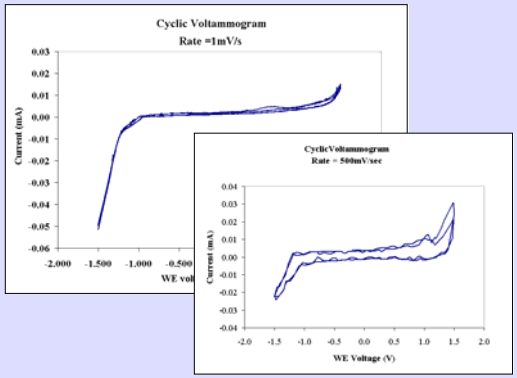
•Tensile properties:

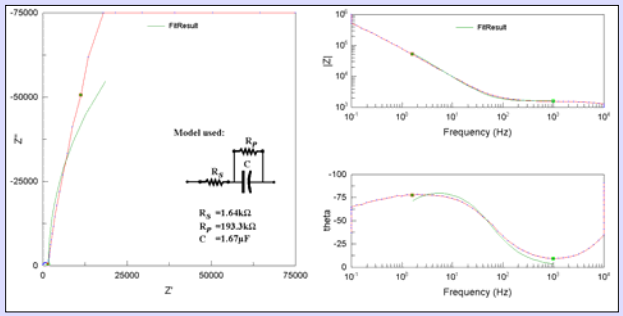
•Young's modulus 15 GPa

•Tensile strength ~ 200 MPa

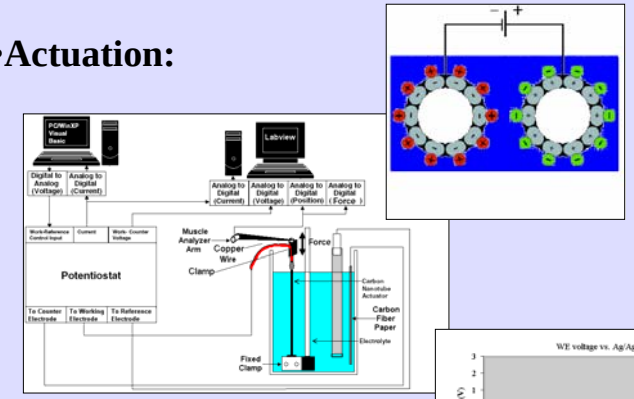


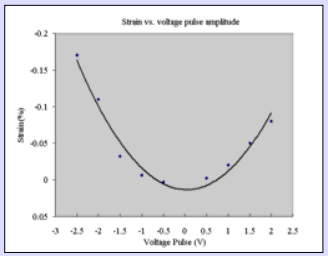
•Electrochemical Properties:

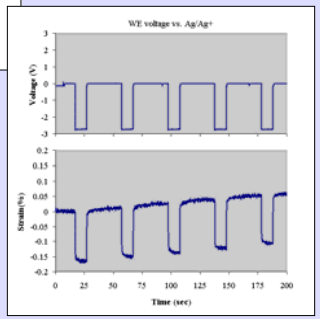




•Actuation:





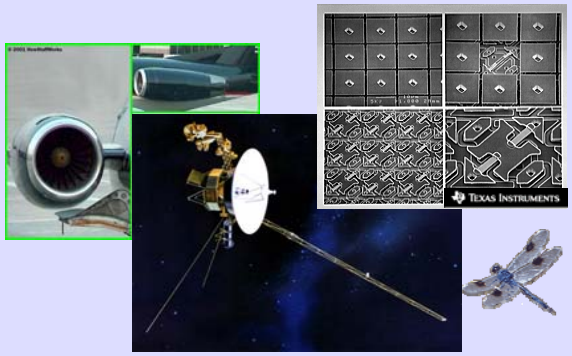


•Empirical modeling:

$$\varepsilon(t) = \beta(t).V^2(t) + \alpha(t).V(t) + \sigma(t)/Y$$

$$= 0.0274V^2 - 0.0022V$$

•Potential Applications



1. Zhang, M. et al. Science (2004), 306(5700), 1358-1361.