RD51 MINI WEEK
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NANOTUBE-COATED RESISTIVE LAYERS TRIALS

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OUTLINE

- Introduction
- Materials
- Preparation of Single Walled Carbon Nanotubes (SWCNT)
- Preparation of Poly(ethylene glycol dimethacrylate-n-vinyl imidazole)/SWCNT
- Results

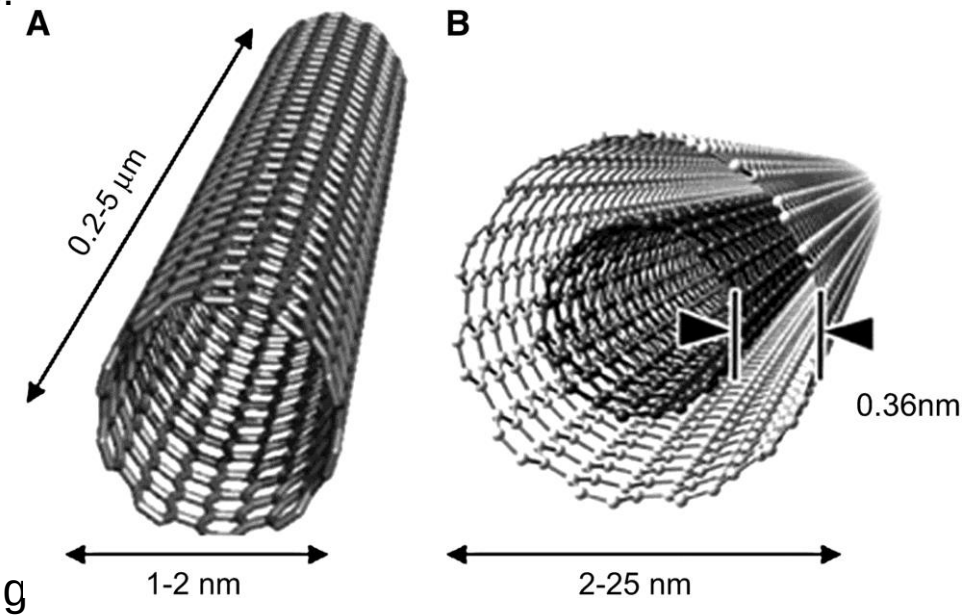
INTRODUCTION

Carbon nanotubes are categorized as:

- Single Walled Carbon Nanotubes (SWCNT)
- Multi Walled Carbon Nanotubes (MWCNT)

Using areas

- Gas sensors
- Fillers in polymer, ceramic and metallic composites
- H storage
- Nanoelectronics, quantum computing



http://jnm.snmjournals.org/content/48/7/1039/F1.expansion.html

MATERIALS

- Ethylene glycol dimethacrylate – EGDMA (Merck)
- N-Vinyl imidazole – VIM (Aldrich)
- 2,2_-Azobisisobutyronitrile – AIBN (Fluka)
- $Ni(NO_3)_2 \cdot 6H_2O$ (Karlsruhe)
- MgO (Sigma)

PREPERATION OF SWCNT'S

- CVD synthesizing
- The catalyst:
  - Impregnation of MgO in an aqueous 1% Ni $(NO_3)_2.6H_2O$ solution for 24 h
  - Drying @ 30 °C
  - Purging with He @ room temperature
  - Ni^{+2} reduction to Ni nanoparticles under He/H_2 flow (60 ml/min) @ 580 °C for 3 h
  - Warming up the furnace to 700 °C @ 10 °C/min for 20 min (CVD process) replacing H_2 with C_2H_2 (20 ml/min C_2H_2 - 300 ml/min He)
  - Decreasing the temperature to room temperature under gas flow

Electrical properties of Poly(ethylene glycol dimethacrylate-n-vinyl imidazole)/Single Walled Carbon Nanotubes/n-Si Schottky diodes formed by surface polymerization of Single Walled Carbon Nanotubes
Muhitdin Ahmetoglu, Ali Kara, Nalan Tekin, Saadet Beyaz, Hakan Köçkar
Thin Solid Films **520** (2012) 2106–2109

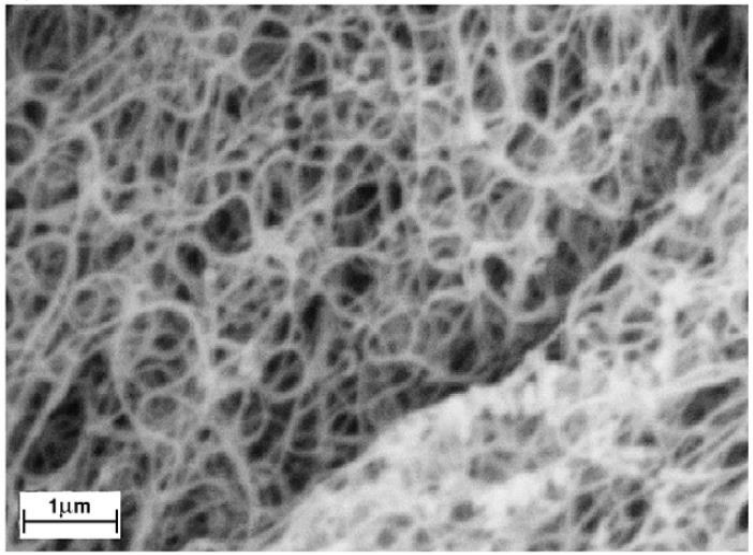
PREPERATION OF P(EV)-SWCNT'S

Table 1 Feed composition for polymerization

EGDMA	VIM	AIBN	TOLUEN	SWCNT
0.3 ml	0.5 ml	0.05 g	1.5 ml	0.02 g

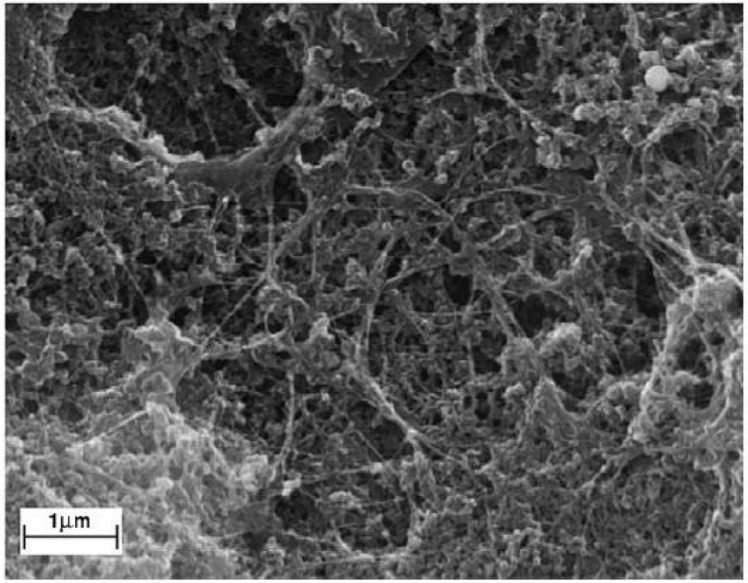
- Degassing of the mixture 30 min by N_2 purging
- Stirring for 2 h @ 25 °C under N_2 atmosphere

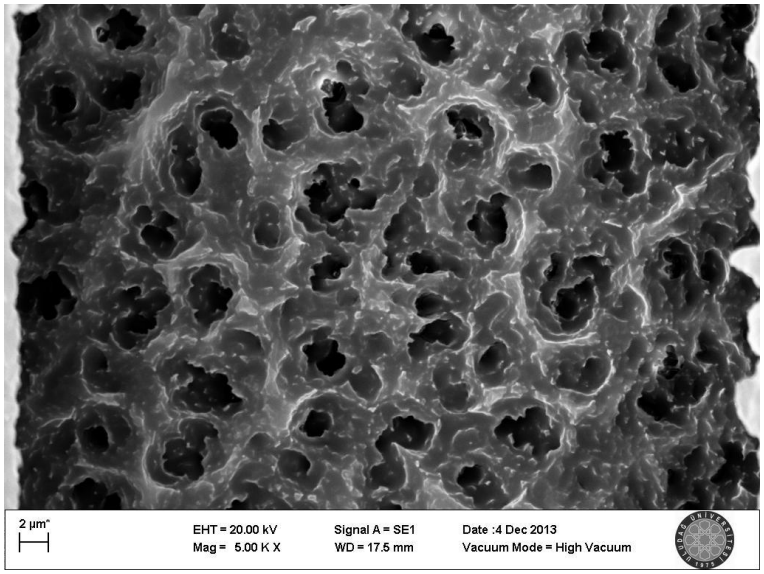
RESULTS



SEM image of SWCNT

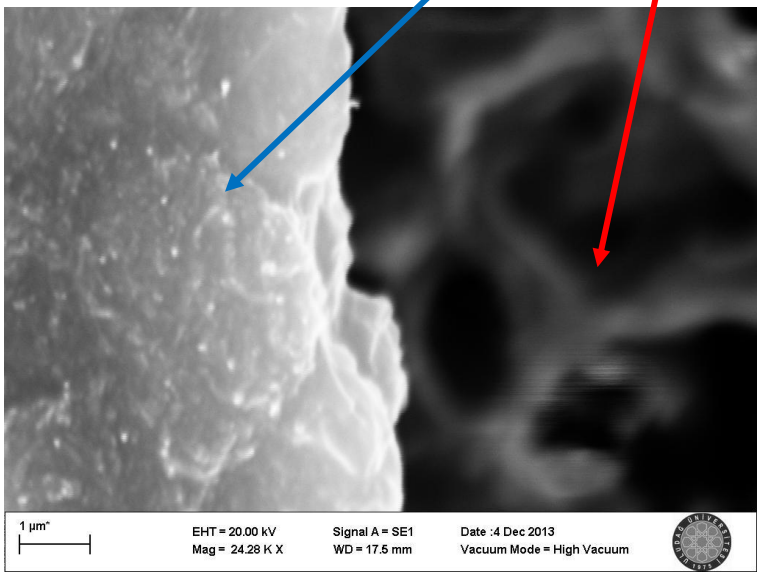
SEM image of SWCNT in P(EV)



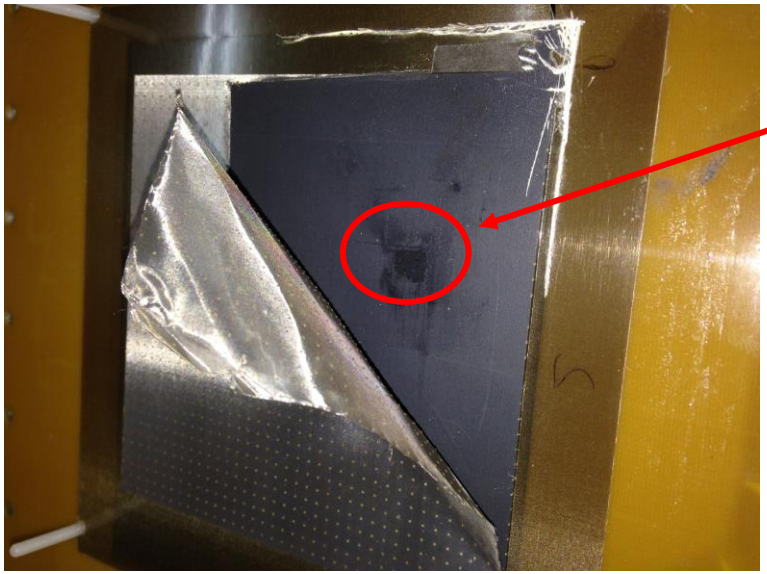


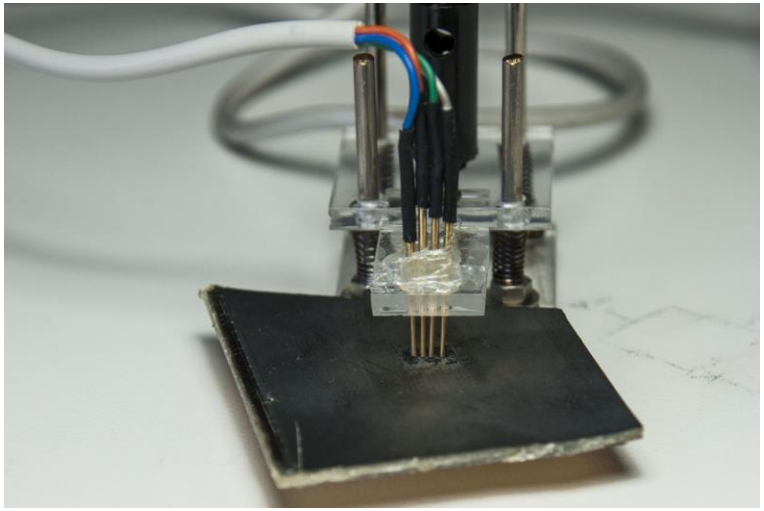
SEM image of epoxy

SEM image of P(EV)-SWCNT/epoxy



P(EV)-SWCNT coated area
6×6 mm^2



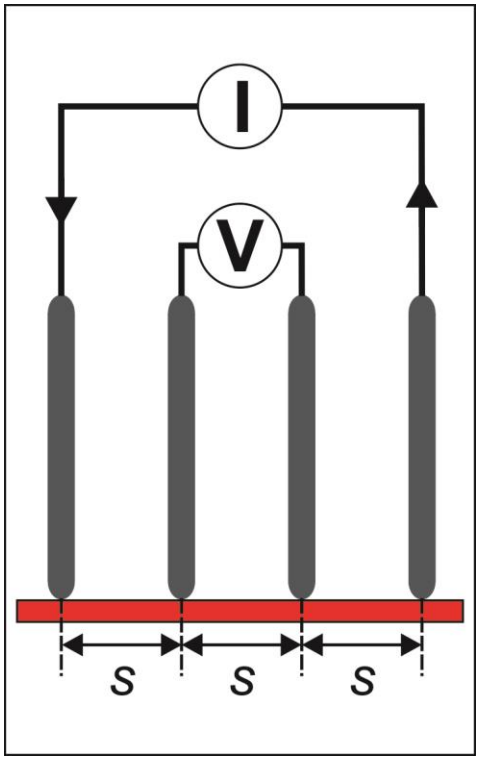


Measurement system

Sheet resistance is given by :

$$R_s = \frac{\pi}{\ln 2}\frac{V}{I}$$

	P(EV)-SWCNT	Epoxy
***I* (μA)**	0.100	0.100
***V* (V)**	1.07×10^{-4}	79.61
R_s (Ω/□)	4.85×10^{3}	3.61×10^{9}



THANK YOU FOR YOUR ATTENTION