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## Synthesis of one-dimensional SnO<sub>2</sub> lines by electrohydrodynamic jet printing for NO gas sensor

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One-dimensional (1-D) SnO<sub>2</sub> line as a representative semiconducting oxide were formed by electrohydrodynamic jet-printing (EHD) of tin chloride pentahydrate and polyvinylpyrrolidone (PVP, 1,200k, Aldrich) solution ink. The 1-D polymer lines including Sn precursors were created by controlling the viscosity, that is, polymer/tin precursor ratio, and adjusting printing conditions such as tip to substrate distance, applying voltage, flow rate of ink and velocity. The printed lines were dried at 200°C to get rid of solvent and finally heat-treated at 600°C to burn out PVP and form tin oxide line. We found out that the linearity and shape of the aligned 1-D SnO<sub>2</sub> could be controlled by adjusting various parameters such as the viscosity of a precursor solution, the ratio of Sn to PVP polymer in the solution, the shape of a cone, the size of a droplet, the applied voltages, the working distance, the flow rate on the glass slides and the Si wafers with a SiO<sub>2</sub> layer, respectively. It is found out that the heat-treatment for the removal of polymers should be tailored to produce continuous 1-D SnO<sub>2</sub> lines due to the drastic volume reduction (> 90%) of the aligned fibers in the annealing process. The electrical and NO gas sensing properties of the 1-D SnO<sub>2</sub> aligned on the Si wafers with Au electrode patterns were evaluated.

### Recent Publications:

1. Hanna Choi,; Jung, Hyunsung; Choi, Duck-Kyun; Kim, Chang-Yeoul, (2016) Alignment of One-Dimensional SnO<sub>2</sub> Lines by Electrohydrodynamic Jet Printing, J.Nanoscience and Nanotechnology, 16(2): 1818-1821
2. Chang-Yeoul Kim, Hyunsung Jung, Hannah Choi, Duck-kyun Choi(2016)
3. Synthesis of one-dimensional SnO<sub>2</sub> lines by using electrohydrodynamic jet printing for a NO gas sensor, Journal of the Korean Physical Society, 68(2): 357–362
4. Go, Eun-Byul; Kim, Hyo-Tae; Kim, Chang-Yeoul Kim(2017), Synthesis of One-Dimensional Pillar Arrays by Electrohydrodynamic Jet Printing for Glucose Sensor Journal of Biomedical Nanotechnology, 13: 61-67
5. Thi My Linh Dang a, b, Dae-Ho Yoon b, Chang-Yeoul Kim(2016), Synthesis of AlN whiskers using cobalt oxide catalyst and their alignments for the improvement of thermal conductivity, Materials Chemistry and Physics, 179: 204-213
6. Ko, Eun-Byul; Choi, Jae-Seok; Jung, Hyunsung; Choi, Sung-Churl; Kim, Chang-Yeoul(2016), Journal of Nanoscience and Nanotechnology, 16: 1934-1937.

### Biography

Chang-Yeoul Kim has his expertise in passion in developing sensor nanomaterials and applications. He focuses on the synthesis of nanomaterials by using solution chemistry, atmospheric chemical vapor deposition, and electrohydrodynamic deposition methods, etc. He showed that it is possible to fabricate SnO<sub>2</sub> lines by using electrohydrodynamic ink coating and could be applied for sensor materials. The SnO<sub>2</sub> lines are comprised of 20nm-sized nanocrystals and show the sensitivity to NO gas. He is interested in the development of sensor device by using these sensor materials.

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