Roll to Roll CVD Graphene Technology for Transparent Electrode and Flexible Display

Yoo Yeob Jung
CEO of Nanotech Digital GmbH
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<td><strong>CEO</strong></td>
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<td><strong>Goal</strong></td>
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| **Business Field**     | • Transparent Electrode film  
                          • Roll to roll CVD Graphene & Graphene Oxide Solution  
                          • Evaporation System for CsI Deposition (Film X-ray detector)  
                          • Sputter System for Sensor, LED & Packaging  
                          • Semiconductor & Display Cost Saving Product - Dry Pump Energy & Gas Saving Tools |
| **Location**           | Nanocenter Dresden  
                          Maria-Reiche Str.1,01109, Dresden, Germany |
| **Facility**           | Office, LAB I, LAB II (Newly Expanded), LAB III (Under Planning) |

- **Target Customers**: Automobile, Display & Semiconductor, Mobile, Flexible display industry, Various Film Manufacturers.
- **We are improving productivity** of high purity graphene by Roll to roll CVD method.
- **With diversified Cooperation with engineering companies & institute** suggest best transparent electrode film application and product.
“Nanotech Digital GmbH” is newly established company in Nanocenter Dresden, Germany.

Our technical background and business idea came from various semiconductor and display equipment engineering. Various equipment & process equipment experience lead us to develop roll to roll process technology coordination for transparent electrode film by graphene application manufacturing.

Nanotech Digital GmbH has expert knowledge and know-how on the thin film process technology such as Evaporation, Sputtering and CVD.

Our products include Transparent Electrode Film, Roll to roll CVD Graphene, Dry Pump energy saving products, X-ray Detector Film manufacturing equipment, and Sputter for LED process & packaging process.

We are early stage for setup and we are looking for partners and investors for future cooperation and manufacturing of transparent electrode film application. Nanotech Digital GmbH manufactures and develops not only graphene applications they also develop new products and applications around core technology.
Company Vision

Becoming a Leading Global High-tech Company with creative & effective approach and proactive action in business field.

- Creative
  - Customized Solution Providing
  - Knowledge Convergence

- Effective
  - Simple Working Process
  - Wide Spread Human Network

- Minimum Cost
- Proactive
  - Technical Marketing
  - Application Development

Maximum Efficiency
Core Technology of Nanotech Digital GmbH
Roll to roll CVD Graphene is the solution for Transparent Electrode film can replace ITO Film and can support future flexible display. Nanotech Digital GmbH transparent electrode film technology is one of the solutions for future flexible display and replace ITO markets.

- Transparent
- Flexible
- Endurable
- ITO film Quality

Application: Smartphone, Automobile window, Building Window
Graphene Transparent Film Application

- Flexible Transparent Display
- Transparent Electrode
- Transparent Solar cell
- Transparent Sun roof
- Transparent Electrode Film
- Automobile Window Pop-up Display
- Roll Display
**Difficulty in Graphene Commercialize**

- **CVD Graphene** manufacturing method can produce the high-quality graphene, but it needs high investment costs for mass production, so the situation is still insufficient for the commercialization.

- **Roll to Roll CVD** is the solution for the CVD Graphene method’s weakness for production yield and investment cost issues.

Roll to roll CVD Graphene Technology

- Development of Graphene Equipment:
  - CVD (Chemical Vapor Deposition), Transmission Equipment

- Development

- Batch-Type
- Pilot Roll to Roll

- Development

- Cluster-Type
- Roll to Roll
  - Mass production

- Transmission Equipment
Film Heater with Graphene

Flexible film heater is applicable to various fields. It can be used for various purposes such as clothing, shoes, outdoor products because of low power consumption and possibility of making film type heater.

- Power : 5V
- Max Temp : 38 ~ 70
- Type : Film type
- Shape : Square, Round

Application : Outdoor wear, shoes, etc
Graphene Film Heater Application

- Flat Film Heater
- Small Round film Flexible Heater
- Roller able Film Heater
- Outdoor application
Product of Nanotech Digital GmbH
Graphene Product of Nanotech Digital GmbH

- **Graphene Product** – Transparent Electrode Film, Film Heater, Graphene Copper Foil, Graphene Oxide Solution, Graphene Polymer, Copper Foil, etc
- **Graphene Equipment** – Graphene R&D CVD, Transfer, etc
PVD System of Nanotech Digital GmbH

- Evaporation System for X-ray Film Detector film (CsI–Deposition)

- **Purpose**: Flat Panel X-Ray Detector Film layer Coating
- **Spec**: CsI Deposition Duel Cell
  - TlI deposition: Single Cell
  - Uniformity (5%)  
- **Substrate**: ~ 17”, Size is adjustable
- **Coated Film Layer**: Height: 700um, Column diameter: 5~6um
- **Type**: Fine Coat & Mass Production
Dry Pump Energy Saving Tools

- Power and Gas Consumption Saving tools
  - To reduce the power consumption of the dry rotor pump in the semiconductor manufacturing line
  - Max. 55% power consumption and 50% N2 gas consumption reducing
  - Easy installation at the outlet
  - Only operated with compressed air > 5 bar
  - Almost no maintenance is required.
  - Applicable to dry rotor pumps of Load Lock chamber
  - Size: KF25, KF40
  - Patent Registered
Future of Nanotech Digital GmbH
SWAT analysis for Nanotech Digital GmbH

- Technology for the high quality graphene mass production: Roll to Roll
- Mass Production Experience
- Global Network
- Global Outsourcing Ability

- Small Company Size
- Human Resource
- Small Capital & Budget

- No Massenproduction for roll to roll CVD
- Graphene
- Diversity of Graphene applications

- China Market and Technology Growing
- Replacement Technology
Global Network for Nanotech Digital GmbH

Mineapolice, USA
Boston, USA
Dubai
Beijing, China
Taiwan
Shinju, Taiwan
Mumbai, India
Tokyo, Japan
New York, USA
Ireland
Valencia, Spain
France
Beijing, China
Shanghai, China
Dubai
Mumbai, India
Singapore
San tosa, Singapore
America
San Jose, USA
Planned on 2018
Korea
Hwasung, Korea
Since Mar. 2011

Global Network for Semiconductor and Display Industries

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THANK YOU

- Address: Maria-Reiche Str.1, 01109, Dresden, Germany
- Tel: +49-(0)351-8889-0271
- Fax: +49-(0)351-8889-0274
- E-mail: nanotechdigital@outlook.com
- Homepage: www.nanotechdigitalgmbh.com
- Contact Person: Y.Y. Jung