

# Mass Production Technology for Flexible Electronic Devices with High-performance Using Single Crystalline Thin Film Semiconductor

Dr. Jae-Hyun Kim  
Department of Applied Nano Mechanics  
T. +82 - 42 - 868 - 7550  
E. jaehkim@kimm.re.kr

➤ Transfer technology of high-performance electronic devices made with single crystalline thin film semiconductors (or high-performance thin films synthesized under high temperature process) on flexible substrates for continuously mass-producing flexible electronic devices of high-performance

### Client / Market

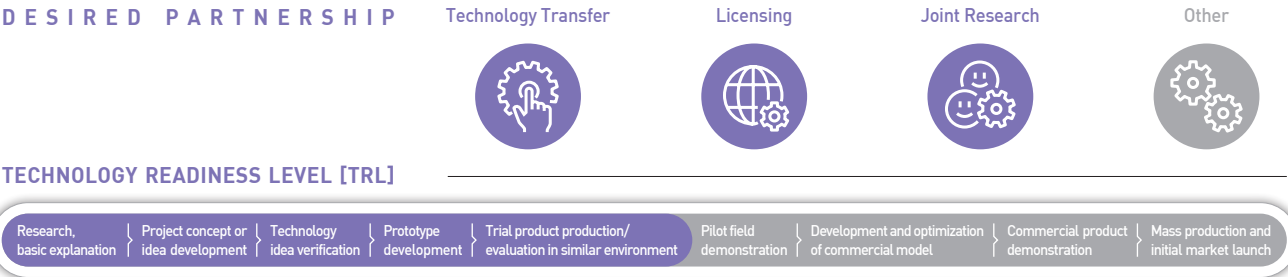
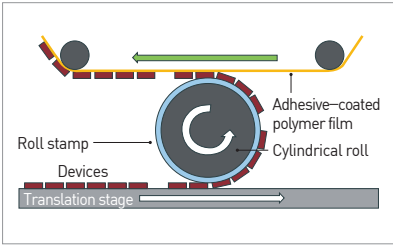
- Inorganic micro-LED display with high-performance, flexible compound semiconductor solar cell, flexible thin film battery, wearable and implantable devices and sensors for human body

### Necessity of this Technology

- Development of a flexible electronic device technology with high performance and great flexibility
- The performance of flexible electronic devices made with organic matters is very low, and electronic devices made with the semiconductor technology has high performance but low flexibility. There is a need for a manufacturing technology for a flexible device with high performance.
- Development of a rollable tablet PC or high-performance display demands a production technology that can satisfy high performance and flexibility requirements.

### Technical Differentiation

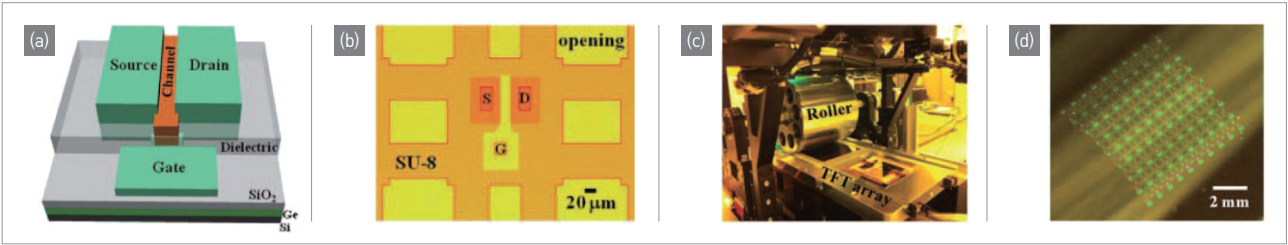
- It is possible to realize and commercialize flexible electronics devices with high-performance using the well-established silicon semiconductor technology. This is also beneficial to securing yield and reliability of the flexible electronic devices.
- High performance thin film material synthesized under a high temperature can be integrated with a flexible polymeric film.
- It is possible to realize a flexible device with the best performance by transferring an electronic device with the today's best specifications on a flexible film.
- The difference of this technology compared to competing technologies (organic matter-based printing technology) is that it enables flexible electronic device realization using single crystalline silicon, oxide semiconductor, and III-V compound semiconductor that have outstanding properties compared to any organic semiconductors.
- This technology has higher stability regarding humidity and temperature and higher durability than organic device technology.



- An improvement is made to overcome the limitations of the flat stamp technologies by transferring semiconductor thin film on the flexible substrate using a roll-stamp.

### Excellence of Technology

- A high-performance semiconductor device is fabricated in a thin film form on a substrate wafer. The device is lifted off from the substrate wafer, then transferred onto a flexible substrate using a roll stamp. This electronic device boasts great flexibility, and high stretchability depending on the design method.
- Covered by 13 media including Digital Times and SBS on December 27, 2012.



### Current Intellectual Property Right Status

#### PATENT

- Hierarchical Structure and Method for Manufacturing the Same (KR1022016, US8551353, CN200980129153.3, JP5575766)
- Manufacturing Apparatus for Hierarchical Structure (KR1022017, pct/kr2009/005527, US13/122.240, CN201310399672.X)
- Stamp for Large Area Transfer and Transfer System Using the Same Stamp (KR0969998)
- Active Removable Chuck (KR0998087, KR1027752, KR1045102)
- Apparatus for Synchronization between Roll Stamp and Translation Stage (KR1227180)
- Flexible Devices with Inorganic Solid Layers and Method for Manufacturing the Same (KR1093133)