



부산대학교 기계공학부  
PUSAN NATIONAL UNIVERSITY  
SCHOOL OF MECHANICAL ENGINEERING

# 차세대 생산 기술 및 인공지능 기반 시스템 개발

지능 정밀 생산 시스템 연구실 (IPMS Lab)  
기계공학부, 부산대학교

PUSAN  
NATIONAL UNIVERSITY

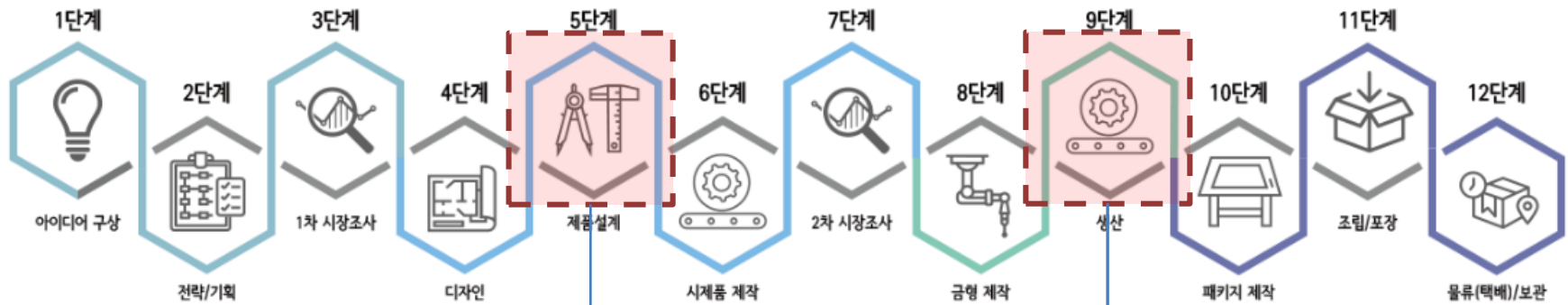


## 지능 정밀 생산 시스템 연구실



## 인공지능 기반 제품 개발 프로세스

제품 개발 프로세스



### 디자인 기술

사용자가 원하는 요구사항에 맞는 제품 디자인을 자동 생성 및 추천

### 공정 최적화

생산 공정 조건에 대한 결과 데이터를 바탕으로 최적 공정 조건 도출

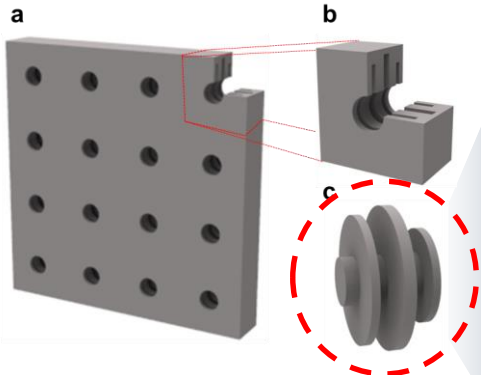
### 설비운용

생산 현장에서 발생하는 다양한 동적 상황에 대한 신속한 자율 대응

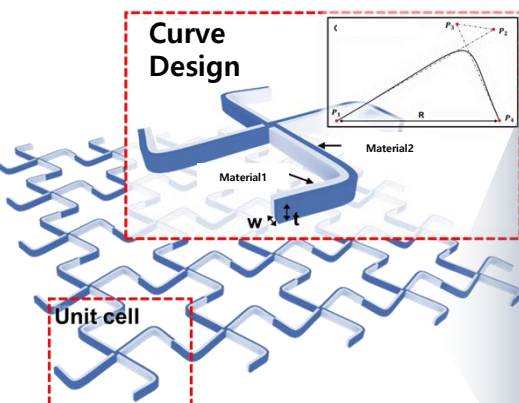
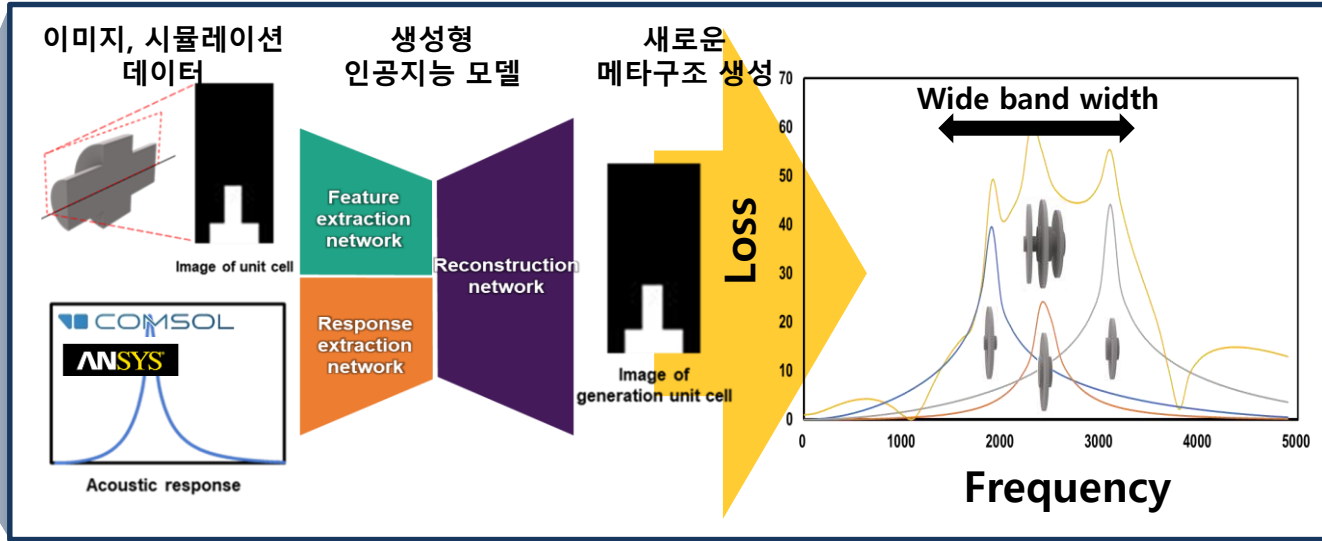
### 품질관리

평균 수율 범위에서 벗어난 제조 공정상 이상 작동 상황이 발생하거나 품질저하 요인을 탐지

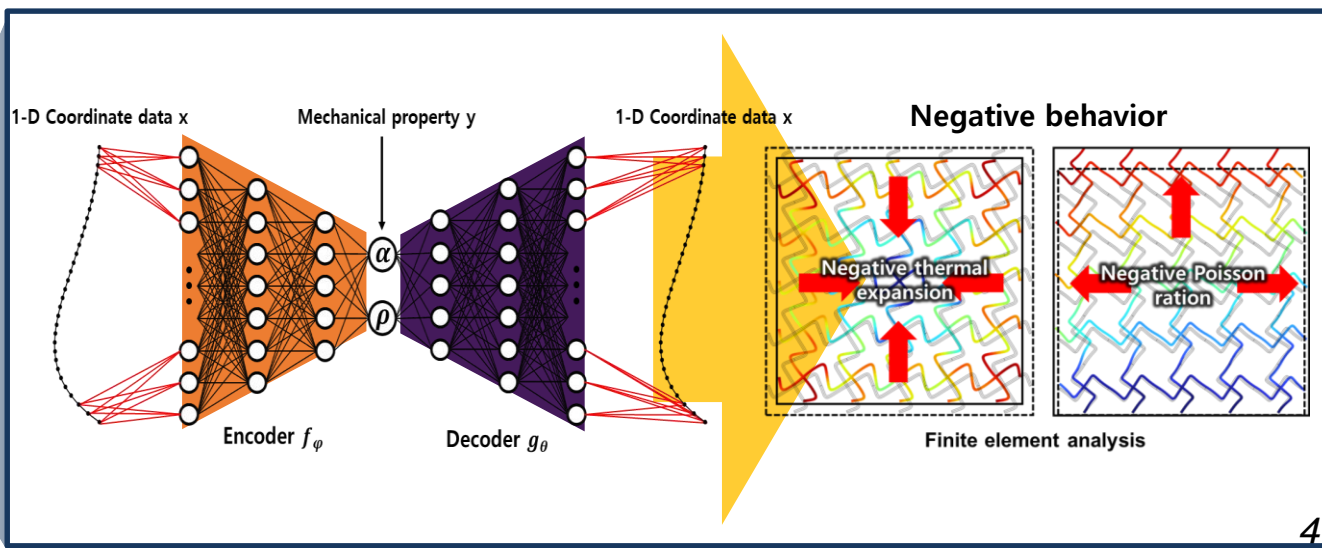
## 딥러닝 기반 음향/기계 메타 구조 설계



Sound reduction acoustic panel

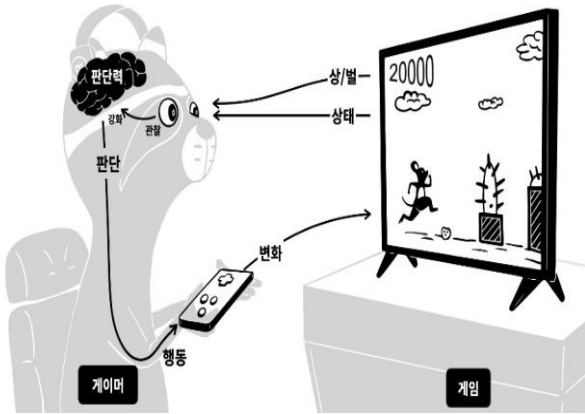


Mechanical Metamaterial



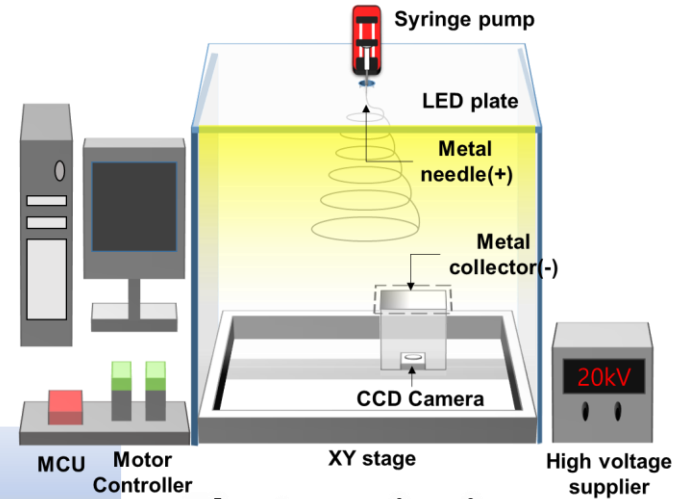
# 연구 관심 분야 - 인공지능 기반 시스템 개발

## 강화학습 기반 생산 시스템 개발



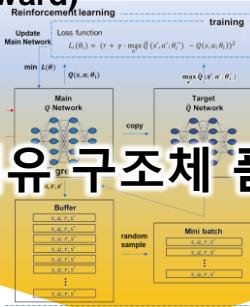
게이머 (Agent)  
 게임 (Environment)  
 행동 (Action)  
 상태 (State)  
 상/별 (Reward)

Reinforcement learning



Electrospinning

나노섬유 구조체 품질 향상



a. Stationary

Step = 40



Step = 80



Step = done



b. Random

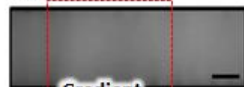
Step = 50



Step = 100



Step = done



c. DDQN

Step = 55



Step = 110



Step = done

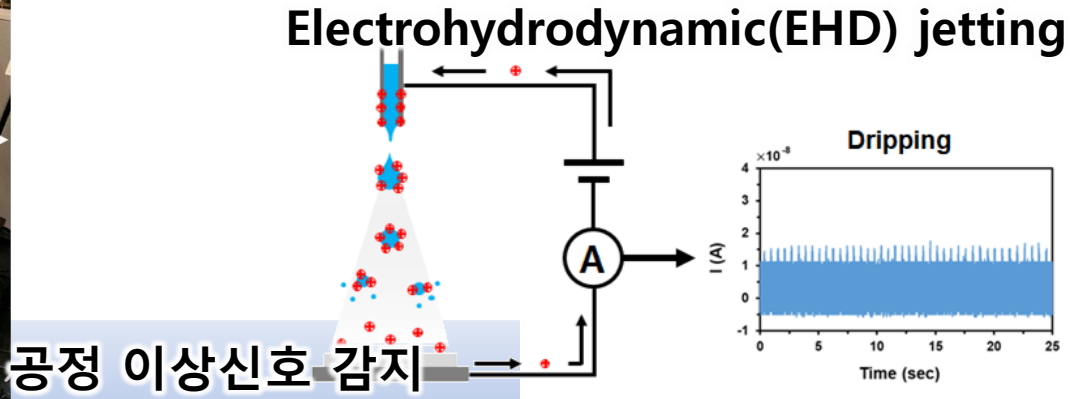
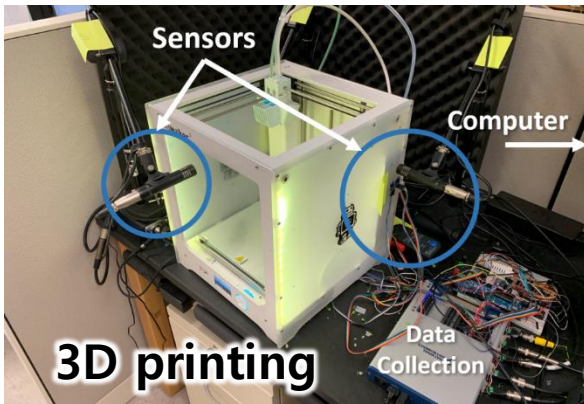


Mode	$\sigma$	NSE
Stationary	5.0214	0.5022
Random	1.7689	0.1779
DDQN	0.8295	0.0834

Increase uniformity

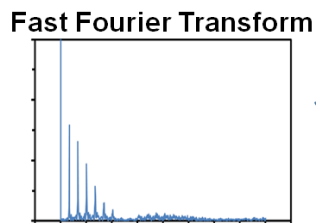
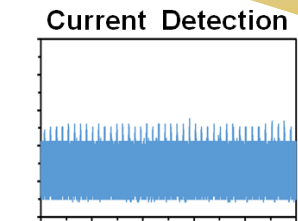
# 연구 관심 분야 - 인공지능 기반 시스템 개발

## 기계학습 기반 생산 공정 모니터링 시스템 개발

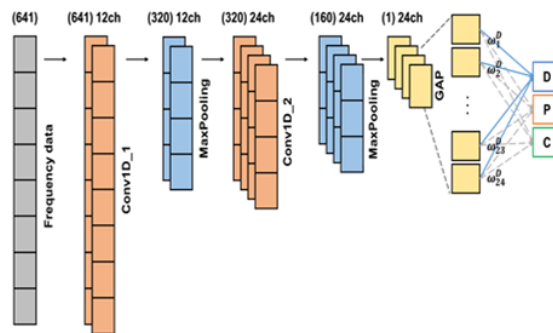


공정 이상신호 감지

기계/전기 신호



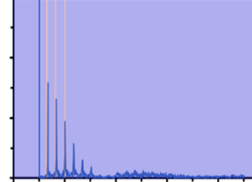
Convolution Neural Networks



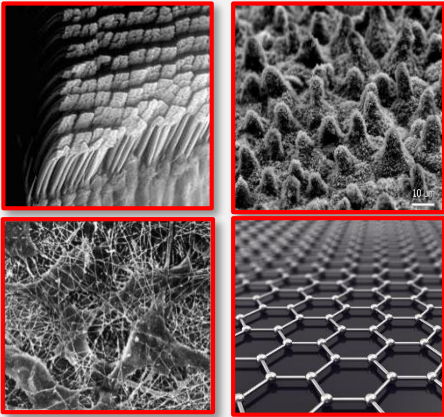
Predicted results

Mode Prediction		
92	0	0
0	40	0
0	0	84

Class Activation Map



# 연구 관심 분야 - 차세대 생산 기술 개발



나노/마이크로 구조

- ✓ 특수한 기능
- ✓ 우수한 성능

나노/마이크로 생산공정



실 생활 적용

## 전통적인 생산 공정



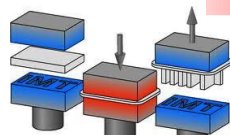
사출성형



단조



압출



핫엠보싱

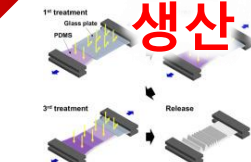
## 비전통적인 생산 공정



전기방사

차세대 3D 프린팅

생산 기술 개발

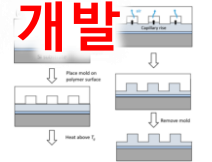


[J.S. Lee, Microelec. Eng., 2017]

주름 공정



Law, J. Mater. Sci., 2017]

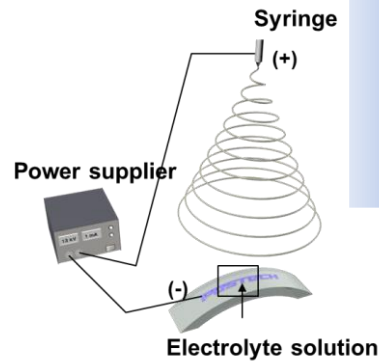
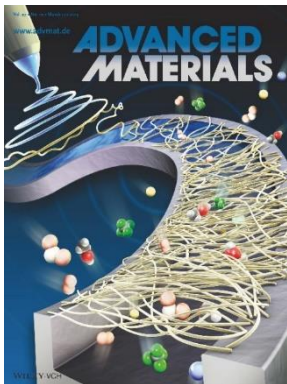
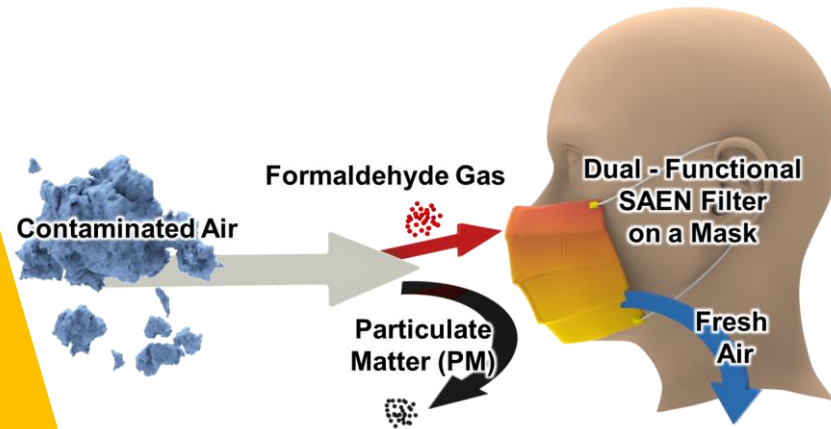
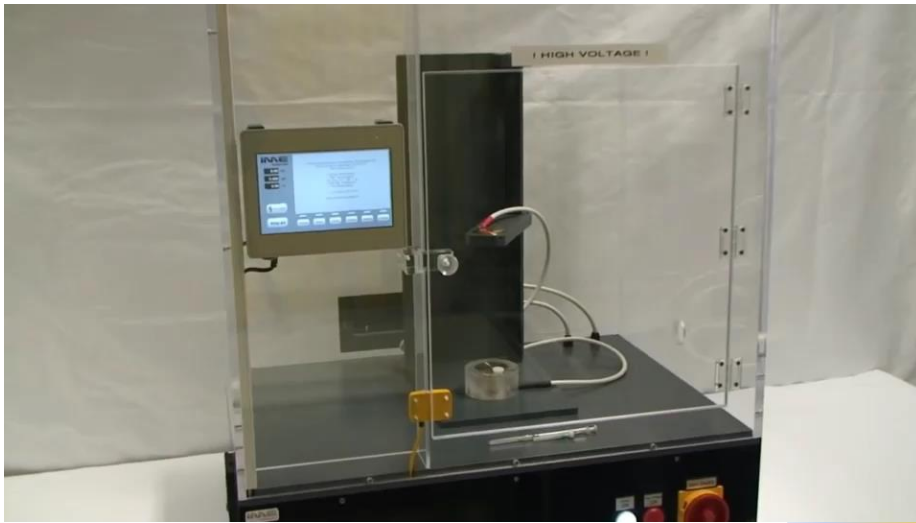


[D. Suh, ACS AMI, 2015]

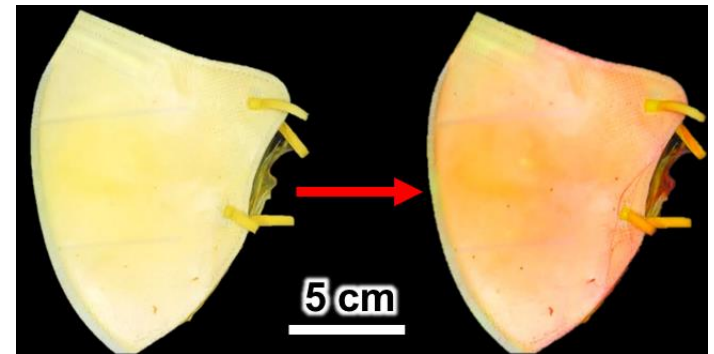
리소그래피



## 전기방사 공정을 통한 이중 기능성 나노섬유 필터 개발



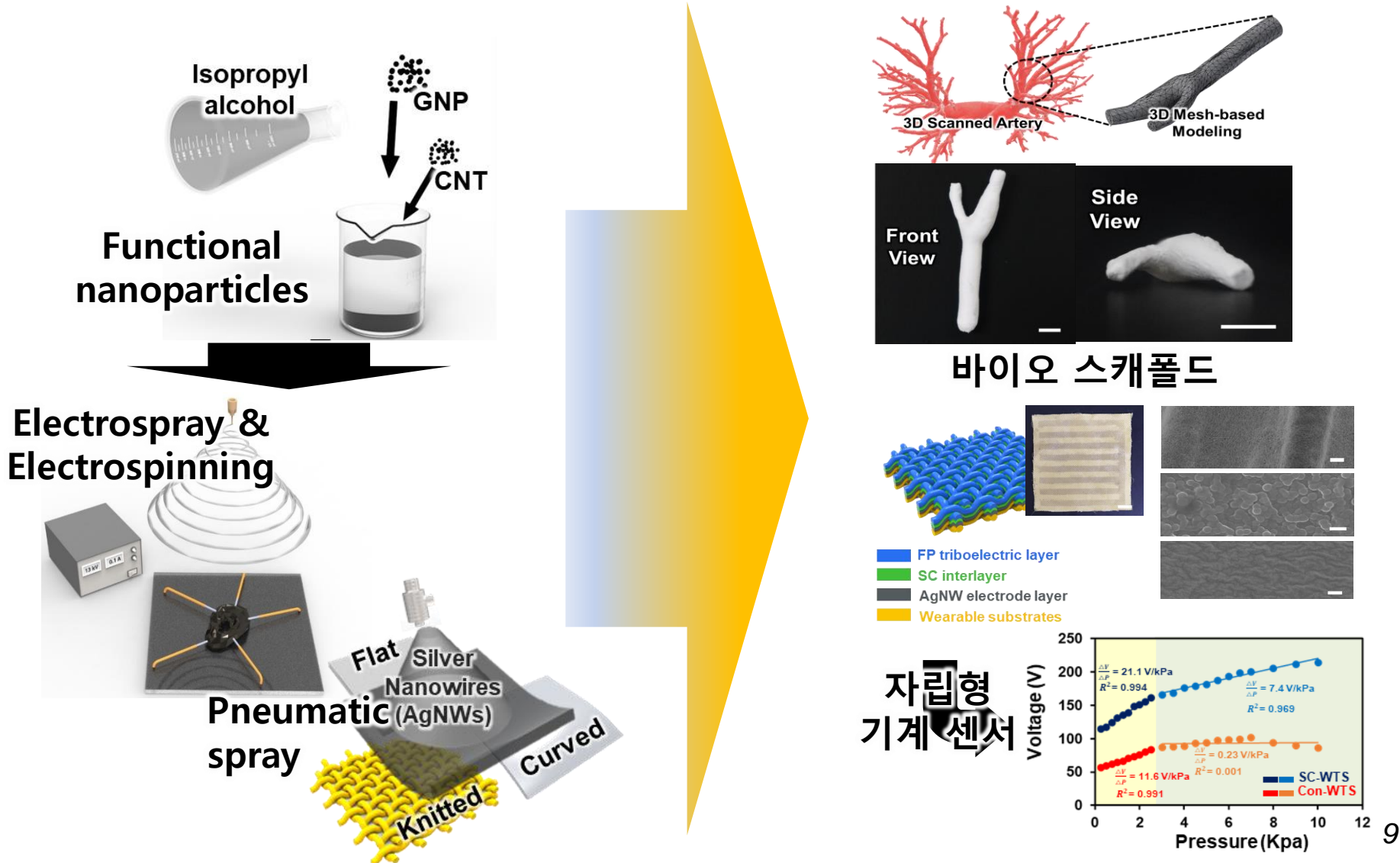
Electrolyte-assisted Electrospinning



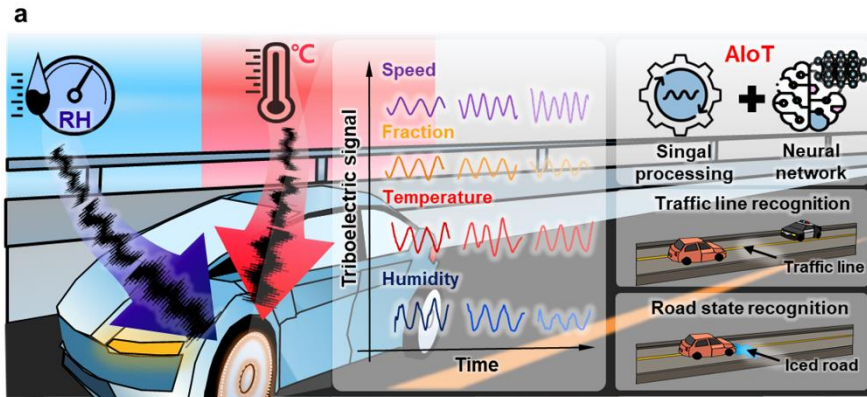
필터 + 컬러릭 센서

# 연구 관심 분야 - 차세대 생산 기술 개발

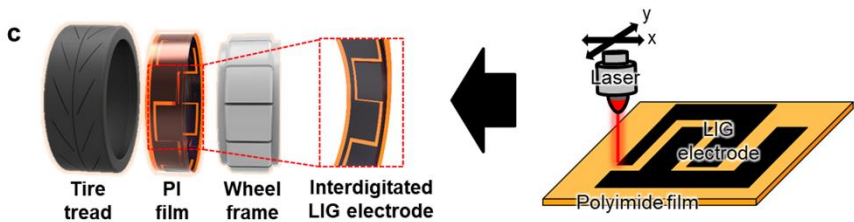
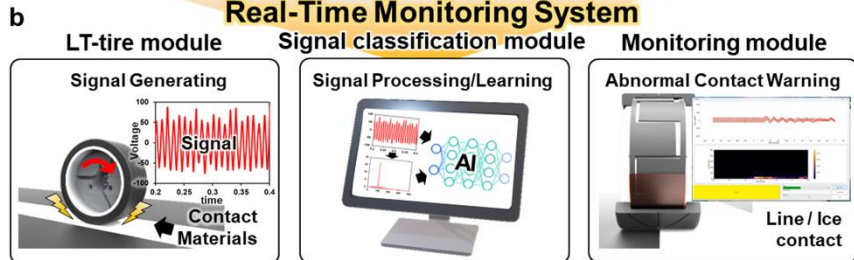
## 나노소재 공정을 통한 복합체 및 자립형 기계 센서 제작



## 레이저 공정을 활용한 자립형 센서 시스템 개발



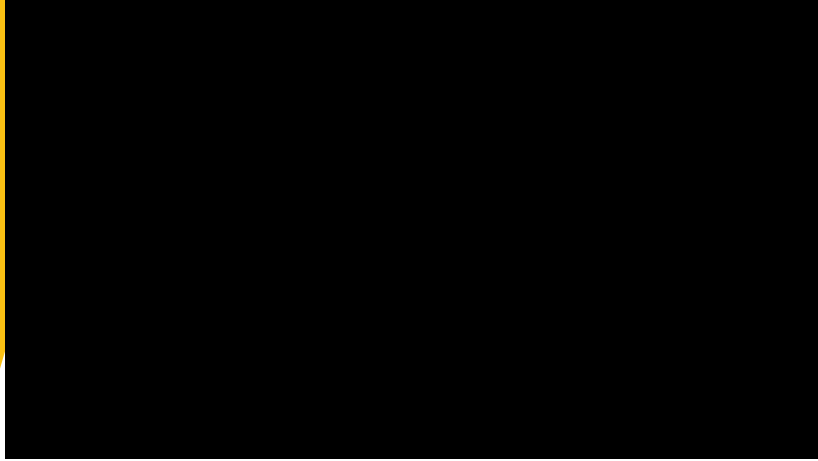
**LIG-based Triboelectric Tire  
Real-Time Monitoring System**



**Video 3:**

Driving test under various humid condions  
(50 / 70 / 90 RH)

B.G. Kim et al.  
IPMS  
Pusan National University



The background features a light blue gradient with decorative elements. In the top corners, there are several white, semi-transparent hexagonal shapes. On the right side, a white grid pattern of thin lines curves and flows downwards, creating a sense of movement and depth. The overall aesthetic is clean and modern.

**THANK YOU**