

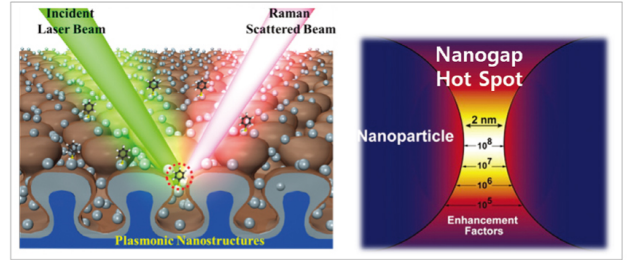
# 초고밀도 나노갭 분자감지 기관소재

## Ultrahigh Density Nanogap Enhanced Molecular Detection Substrates

TRL5

### 기술내용

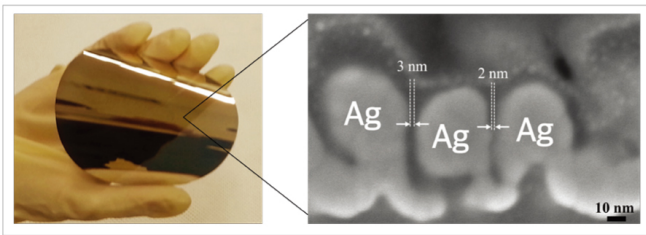
- 표면플라즈몬공명(LSPR)현상을 발생시키는 초고밀도 나노갭 기관소재 기술
- 나노갭(핫스팟)에 존재하는 분자의 라만신호를 수백만배 증폭하여 ppb이하 극미량의 화학성분 분석 가능
- 현장진단용 초고감도 환경센서, 유해화학물 측정센서, 바이오 센서에 활용



Surface-Enhanced Raman Scattering (SERS) 현상

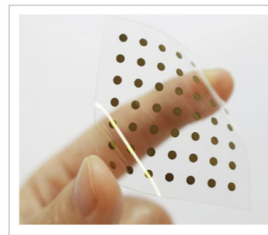
### 고분자기판 기반 SERS 소재

- 고분자기판의 플라즈마 표면처리를 통한 나노구조화 달성
- 저가 대면적 공정기술 확보 (6인치 웨이퍼)
- 초고밀도 나노갭(<10nm) 이용한 감지성능 극대화 구현

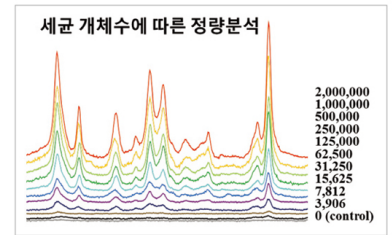


대면적 분자센싱 기관

고밀도 나노갭 구조물



다중 분석 어레이 기관



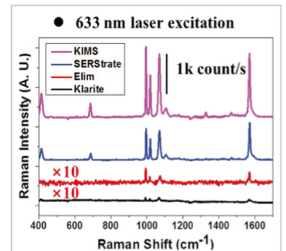
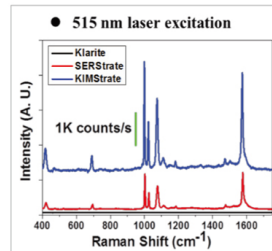
현장 정성/정량 분석

### 우수성

#### KIMStrate 기관 우수성

- 상용제품 대비 우수한 분자감지 성능 R2R 공정 가능

Klarite® Substrates (UK)	SERStrate (Silmecco, Denmark)	KIMStrate (재료연구소)
<ul style="list-style-type: none"> <li>• 실리콘 반도체 공정 적용</li> <li>• 최초의 SERS 상용화 제품</li> <li>• 라만증강지수: <math>10^4 \sim 10^6</math></li> <li>• 가격: 1개당 100\$ 이상</li> </ul>	<ul style="list-style-type: none"> <li>• 실리콘 Dry Etching</li> <li>• 라만증강지수: <math>7.8 \times 10^6</math></li> <li>• 가격: 1개당 \$60</li> <li>• 나노구조체 밀도 = <math>18.0 \mu\text{m}^{-2}</math></li> </ul>	<ul style="list-style-type: none"> <li>• 고분자 Etching</li> <li>• 라만증강지수: <math>3.3 \times 10^7</math></li> <li>• 가격: 1개당 &lt;\$10</li> <li>• 나노갭 밀도 &gt; <math>120 \mu\text{m}^{-2}</math></li> </ul>

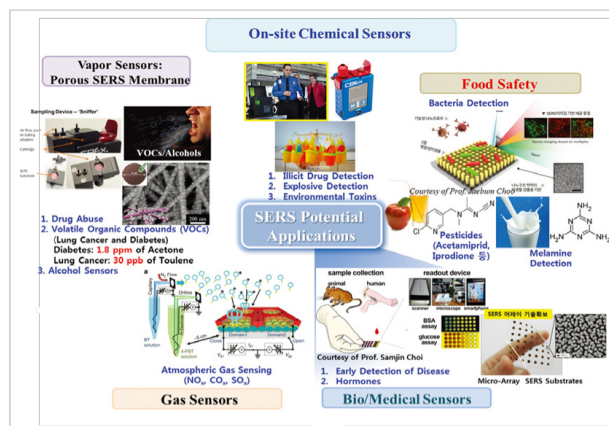


- [특허] KR10-1745558 표면증강 라만산란 기관, 이의 제조방법 및 이를 이용한 분석 방법

### 사업성

#### 활용분야

- 초고감도 수질/대기 환경센서
- 농약, 환경호르몬 등의 유해물 감지 센서
- 질병조기진단 센서
- 환경 및 식품안전 현장진단 시스템 확립
- 질병 및 인체유해인자 조기진단 서비스



# Ultrahigh Density Nanogap Enhanced Molecular Detection Substrates

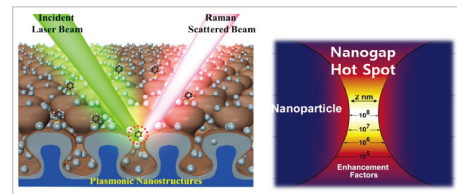
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## Technology Overview

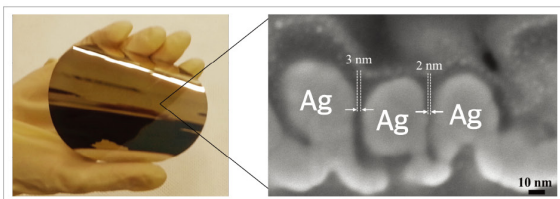
- Ultrahigh nano-gap substrates generating localized surface plasmon resonance (LSPR)
- Analyzing trace of chemicals (at ppb level) by amplifying the Raman signal existent in the nano-gap (hot spot)
- Applicable to highly sensitive environmental sensors and those detecting harmful chemicals for site diagnosis

### Plastic substrate based SERS

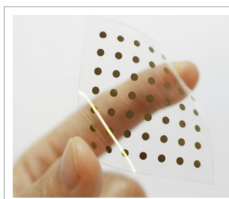
- Achieving nano structure through plasma surface treatment of plastic substrate
- Affordable large-area process (6 inch wafer)
- Maximum detection using ultrahigh density nanogap (< 10 nm)



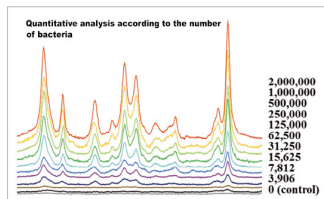
Surface-enhanced Raman scattering (SERS)



Large-area molecule sensing substrate High density nano-gap structure



Multiple analysis array substrate



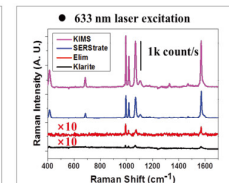
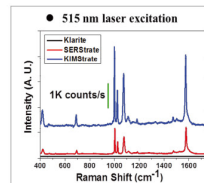
Site quantitative / qualitative analysis

## Highlights and Strengths

### KIMStrate substrate's strength

- Better molecule detection than products on the market
- Higher price competitiveness through use of low cost process and material
- Flexible plastic substrate based R2R process possible

Klarite® Substrates (UK)	SERStrate (Silmecco, Denmark)	KIMStrate (KIMS)
<ul style="list-style-type: none"> <li>- Applicable to silicon semiconductor process</li> <li>- First SERS product commercialized</li> <li>- Raman enhancement factor: 104-106</li> <li>- Price: Over \$100 per unit</li> </ul>	<ul style="list-style-type: none"> <li>- Silicon dry etching</li> <li>- Raman enhancement factor: <math>7.8 \times 10^5</math></li> <li>- Price: \$60 per unit</li> <li>- Nano structure density: <math>18.0 \mu\text{m}^2</math></li> </ul>	<ul style="list-style-type: none"> <li>- Plastic etching</li> <li>- Raman enhancement factor: <math>3.3 \times 10^7</math></li> <li>- Price: &lt; \$10 per unit</li> <li>- Nano-gap density: <math>120 \mu\text{m}^2</math></li> </ul>



- [Patent] KR10-1745558 A SUBSTRATE FOR SURFACE ENHANCED RAMAN SCATTERING AND FABRICATING METHOD OF THE SAME AND ANALYZING METHOD USING THE SAME

## Business Cases

### Applicable products

- Highly sensitive water/air environmental sensor
- Sensors detecting harmful substances (i.e. pesticides, environmental hormones)
- Sensors for disease diagnosis

### Applicable services

- Site diagnosis for environment and food safety
- Early diagnosis of diseases and harmful factors for human bodies

