



마이크로/나노 기계공학

Micro/Nano Mechanical Engineering



보이지 않는 것이 보이는 것을 지배한다!

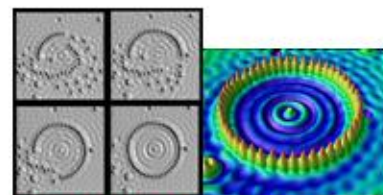
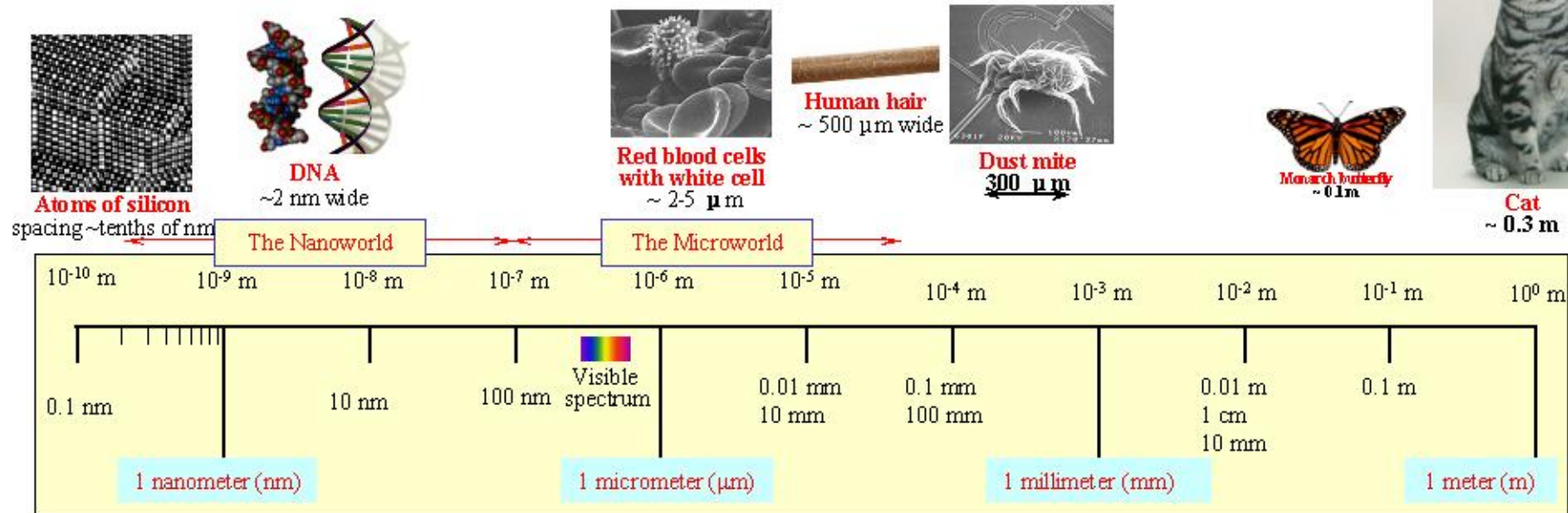
미래 기술은 Micro/Nano 수준의 제조, 제어, 작동, 측정이 필요

->Micro/Nano 기계공학

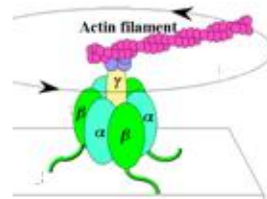
The Scale of Things



Things Natural



Quantum corral of 48 iron atoms on copper surface positioned one at a time with an STM tip
Corral diameter 14 nm



Biomotor using ATP

MEMS (Micro Electro Mechanical Systems) Devices
10 - 100 μ m wide



Red blood cells
Pollen grain



Head of a pin
1-2 mm



Things Manmade

MEMS



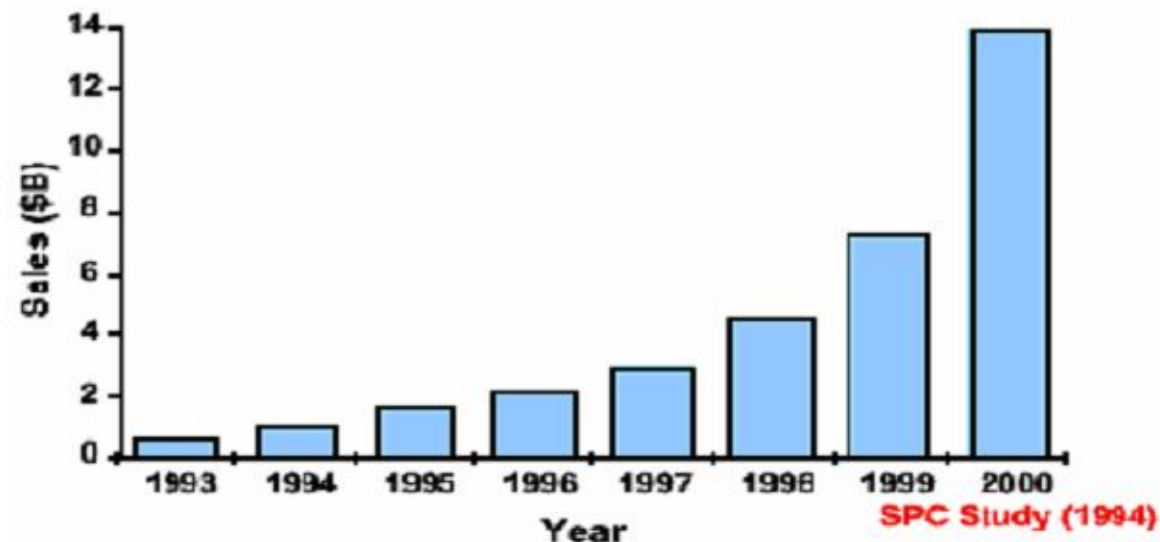
□ Micro Electro Mechanical System (MEMS)

- 마이크로 단위의 기계-전기 시스템
- 반도체공정 이용

□ 다양한 응용분야

- 자동차/우주선 부품, 사무용 설비
- 센서, 전자부품, 컴퓨터주변장치

Projected Growth of Worldwide MEMS Market



MEMS 센서



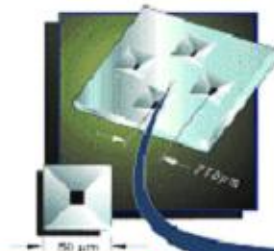
**Navigation
Gyroscope**



Air bag XL

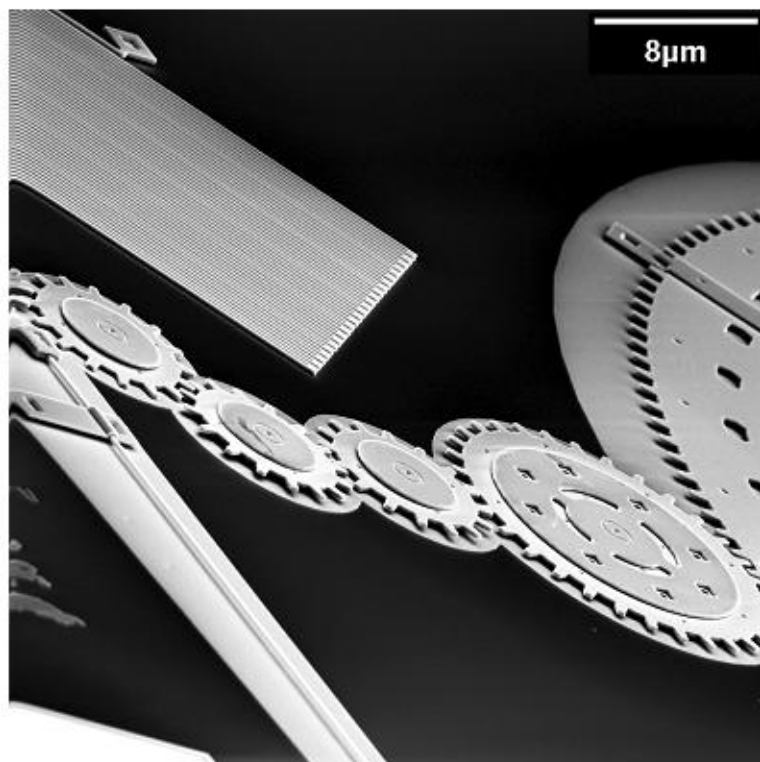


**Silicon
Nozzles**

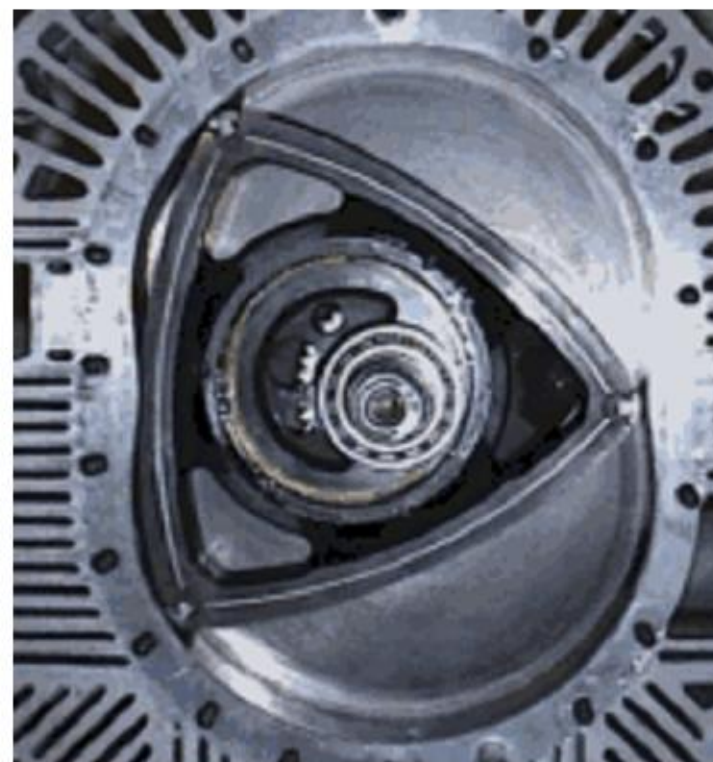


Tire pressure sensor

마이크로 동력 전달 시스템

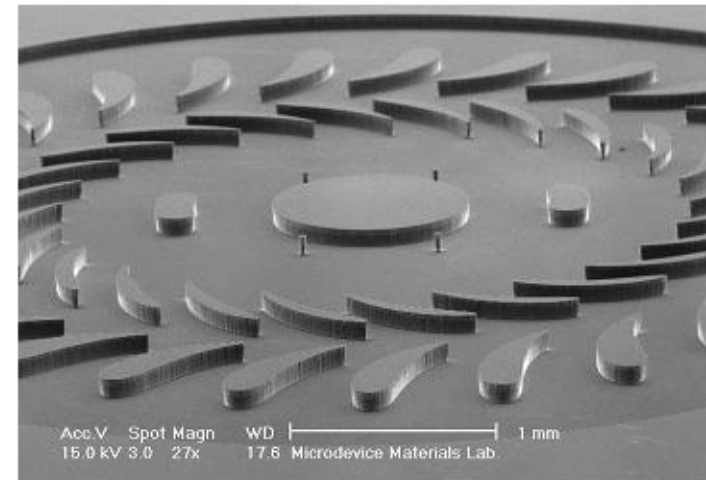
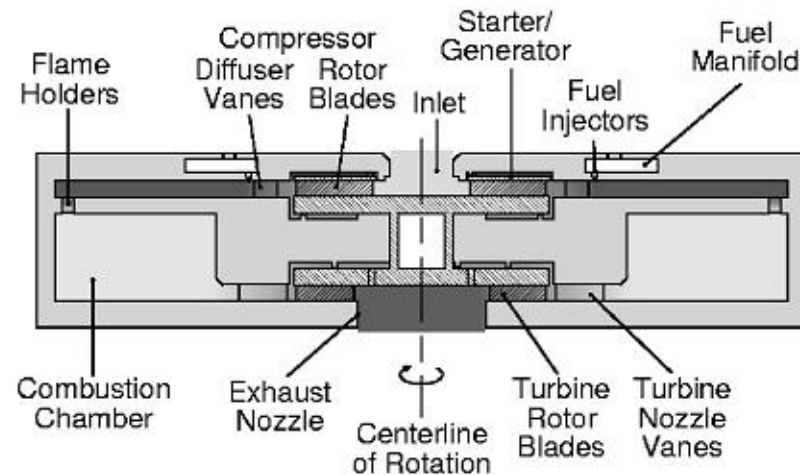


마이크로 기어

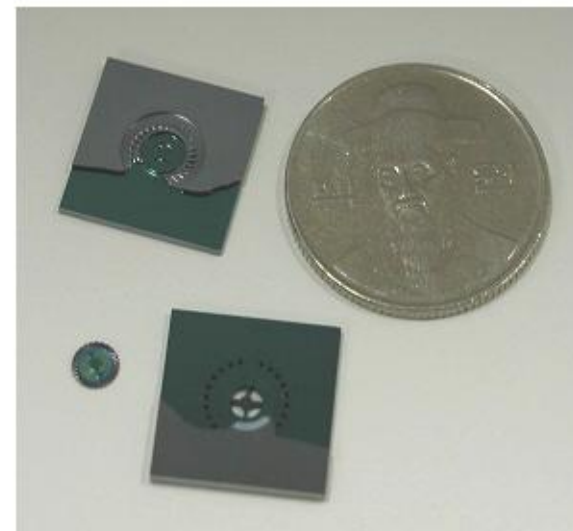


마이크로 내연기관

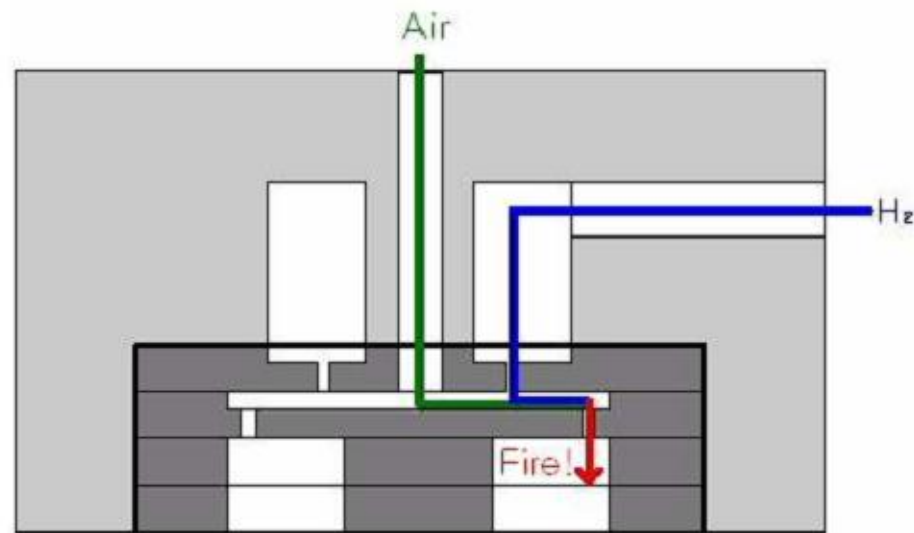
서울대 마이크로 터빈



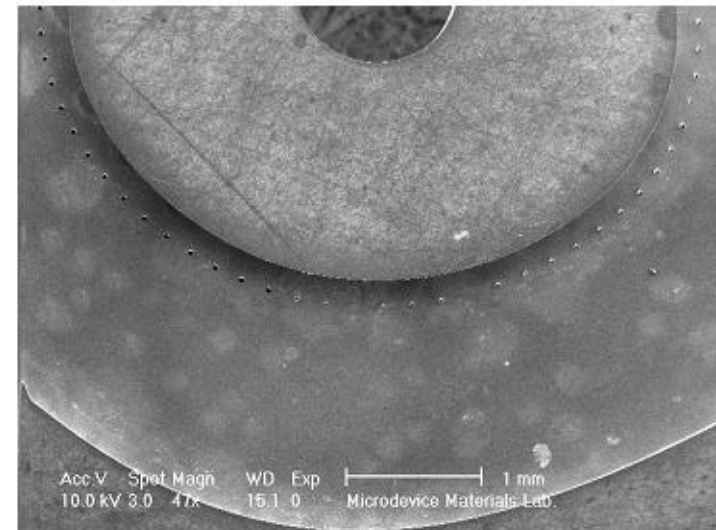
로터 직경 : 4.2mm
블레이드 높이 : 200 μ m
회전수 : 100,000rpm



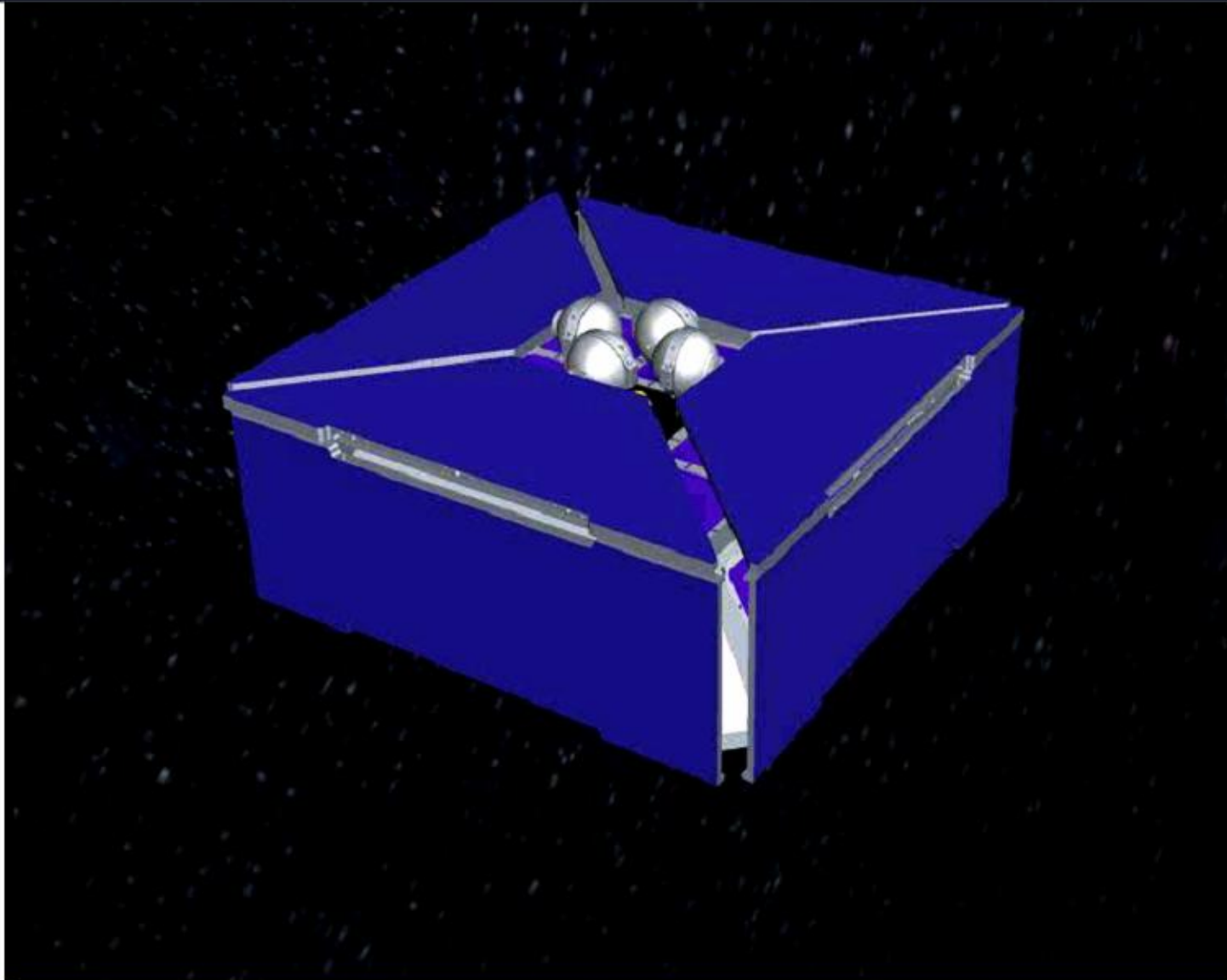
서울대 마이크로 연소기

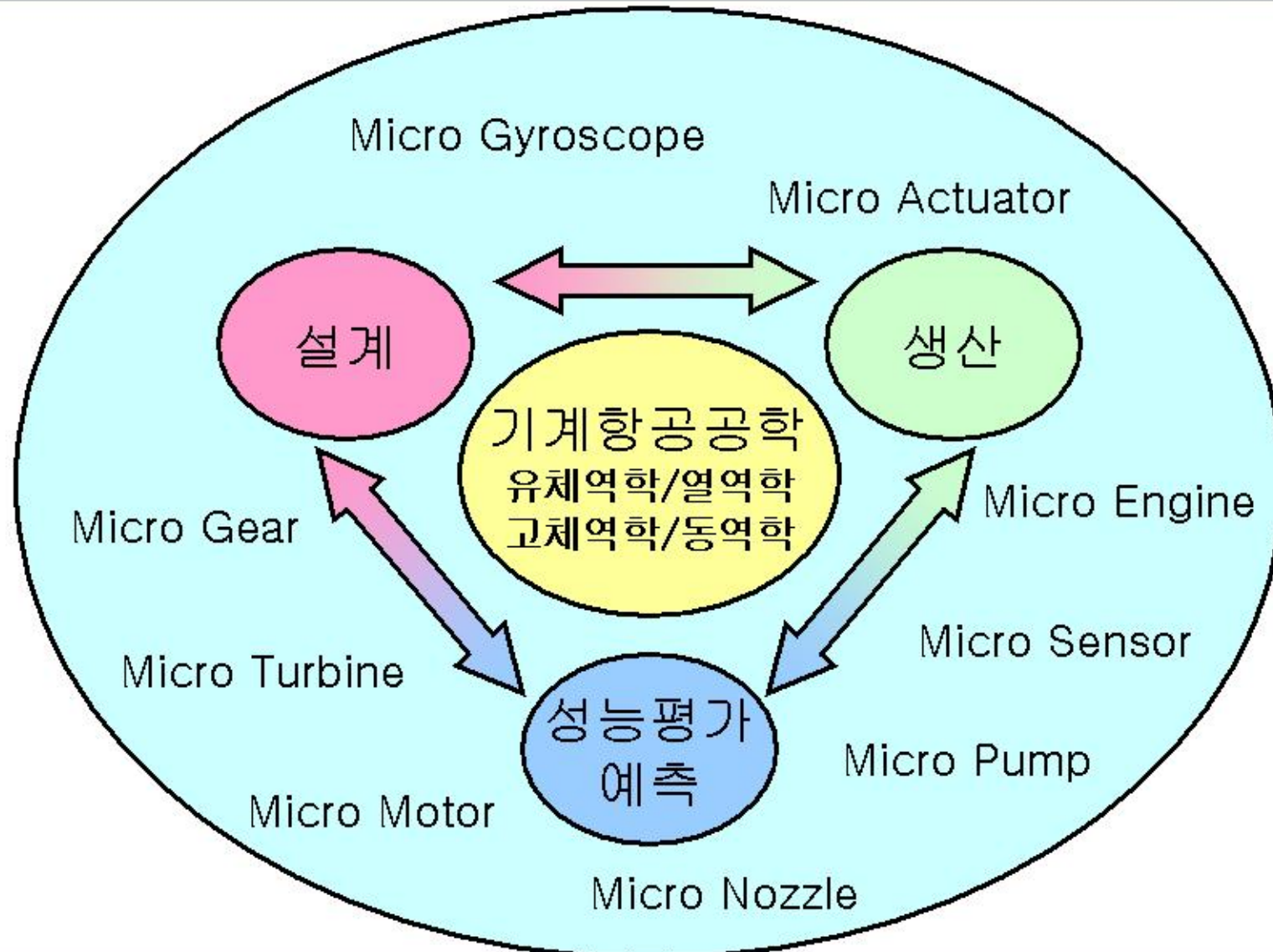


직경 : 1.5cm
입구 면적 : 1mm²
입구 온도 : 1600K
무게 : 1g



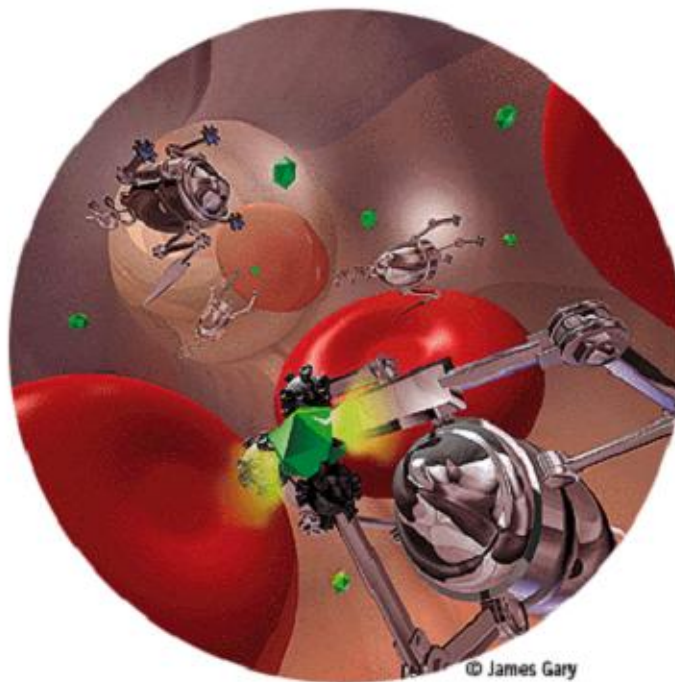
초소형 인공위성





Nanobot : Medicine





**Fiction?
or
Future
Technology?**

Micro/Nano Technology

나노기술과 기계공학



열 및 물질 전달, 임자공학, 유체역학등
기계공학의 기본 원리가 지배

나노물질의 생성,
성장 및 부착제어

나노공정 실용화,
나노물질의
물성에측

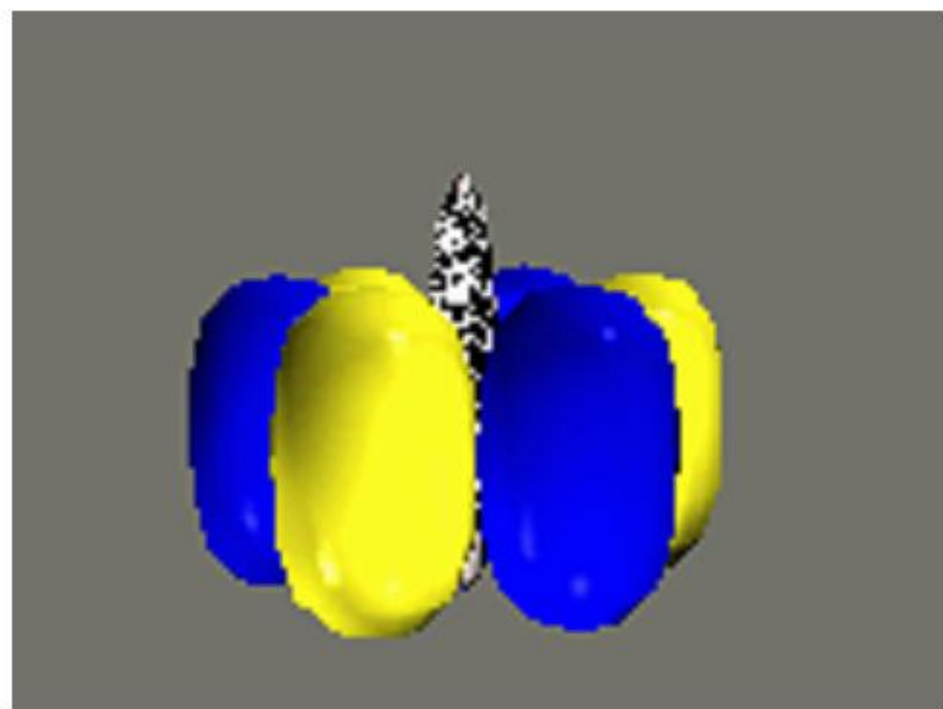
나노패터닝,
나노가공 공정,
구동 및 측정

나노소자
나노소재

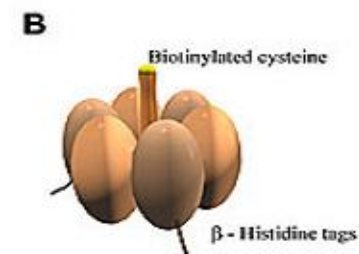
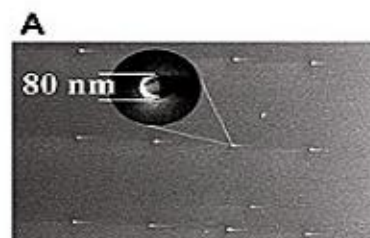
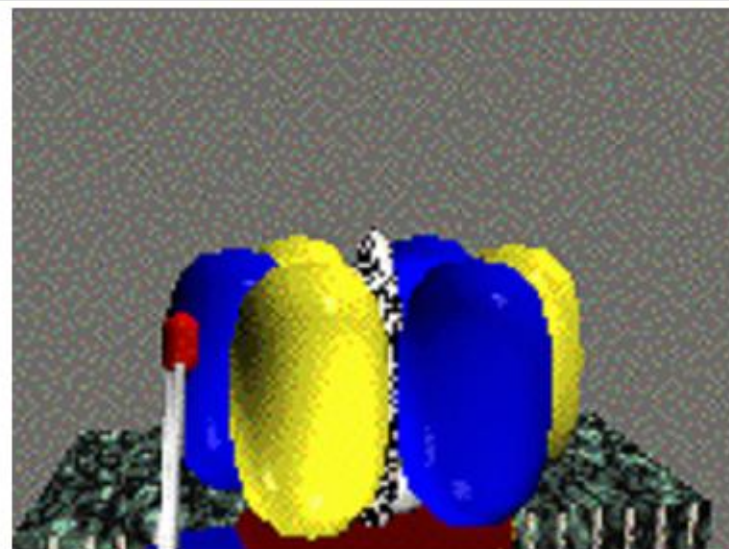
분자역학, 임자역학
+ 열유체, 고체, 동역학적
모델링, 해석필수

나노 스테이지,
나노구동 장치,
나노 머시닝 개발 필수

Nano Molecular Motor



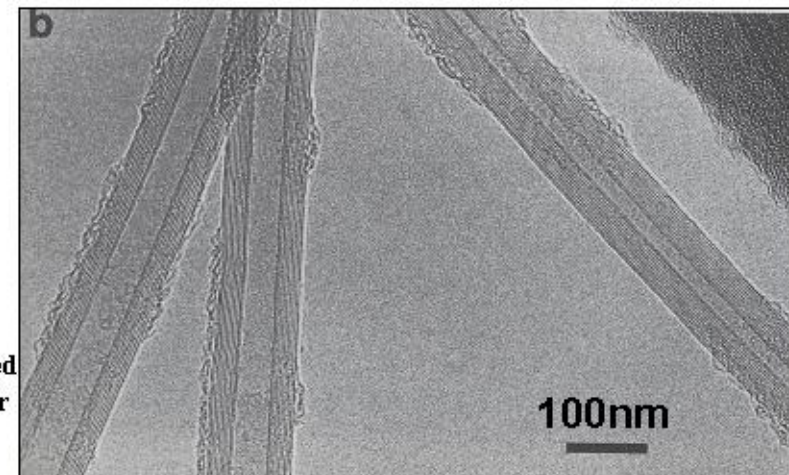
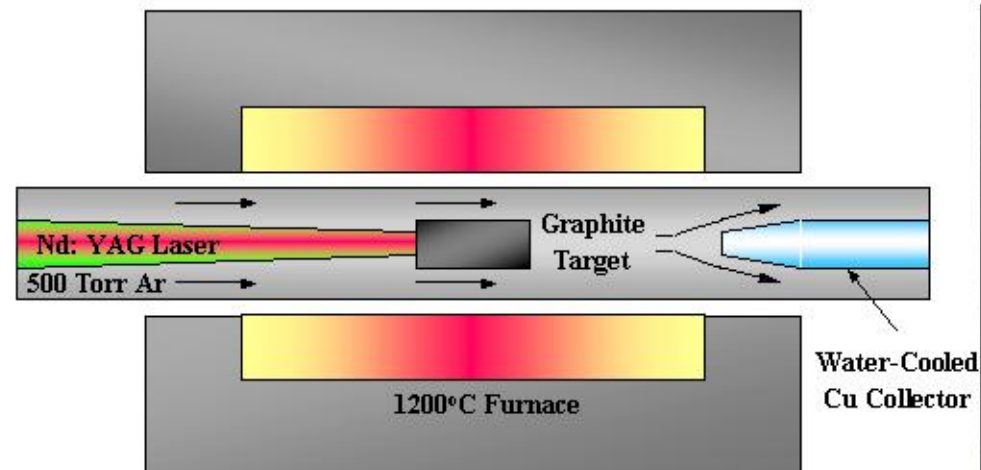
의의: 최초의 나노구동이 가능함





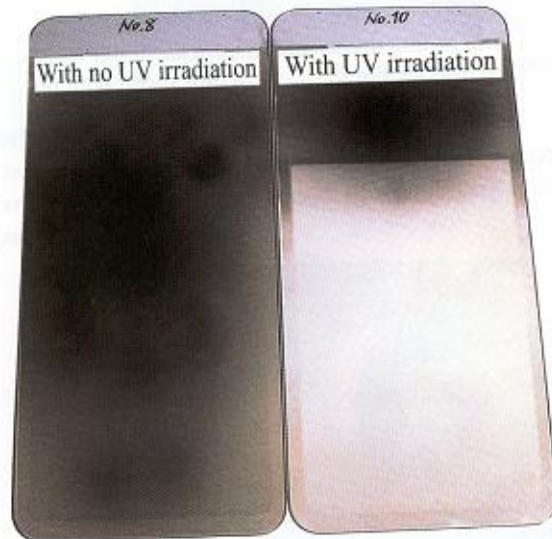
나노 물질 제조는 기계공학적 원리를 이용하여 제조

Carbon Nano Tube - Laser Ablation





Oxidizing deposited soot and other organics



Keeps surfaces clean

Changes hydrophilic characteristics of glass—antifogging TiO_2 coatings



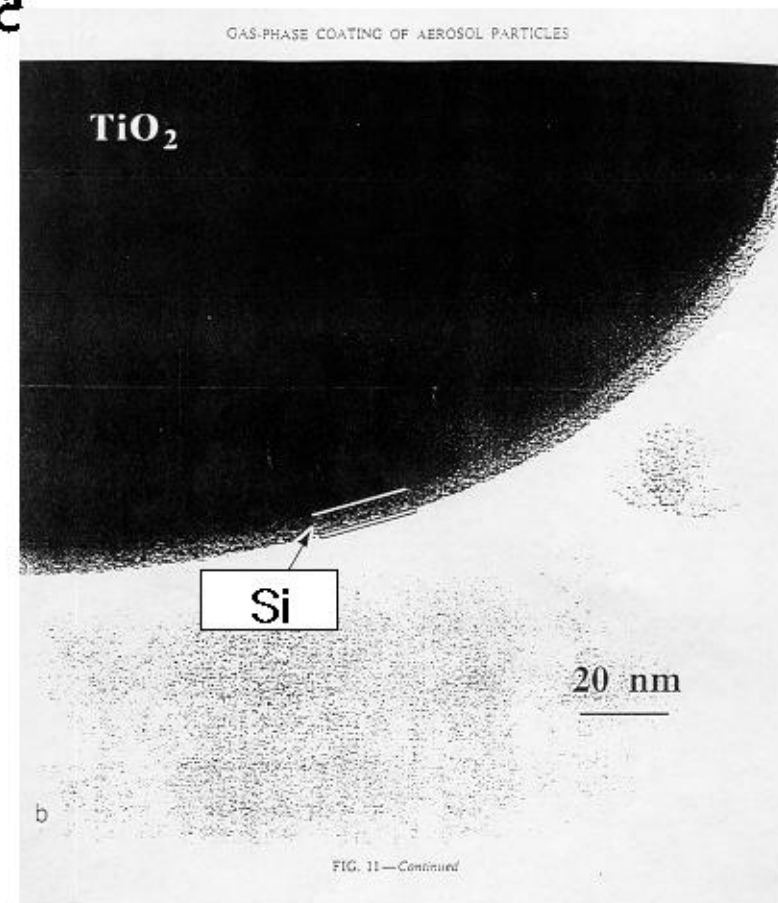
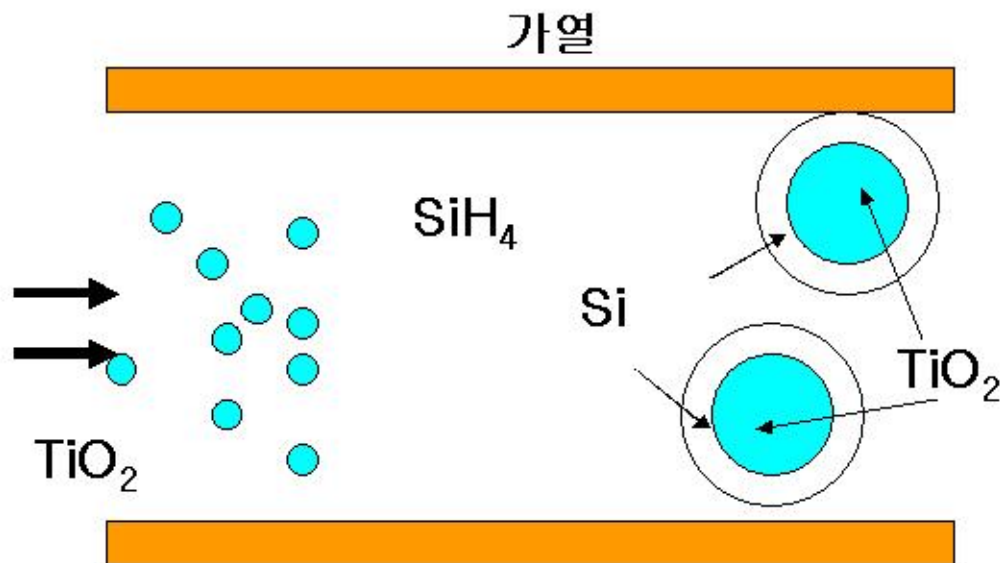
화장품



열전달을 이용한 나노코팅



열전달 → 열분해 → 분자의 생성
→ 분자의 확산 → 나노코팅



나노입자의 형상



서울대학교 기계항공공학부에서 제조한

여러가지 나노 입자와 나노벌크

화염중 충돌과 응집 및
열전달 원리 응용



나노 입자의 특성 제어



우수한 나노물질 제조

