

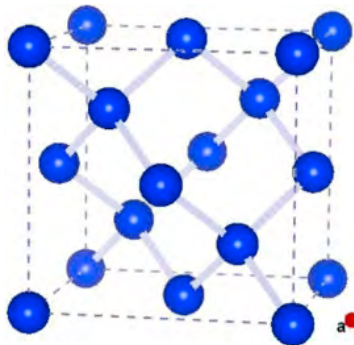
# Nanofabrication and Tools

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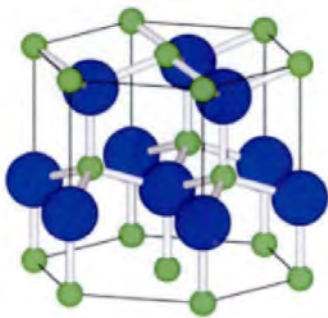
Dr. Huanan Zhang, Program Manager, DARPA/MTO

July 24, 2025

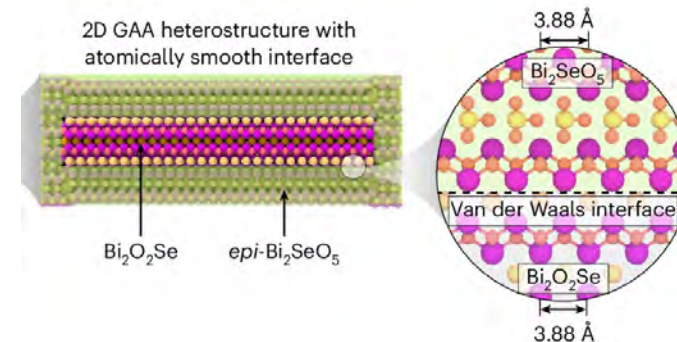




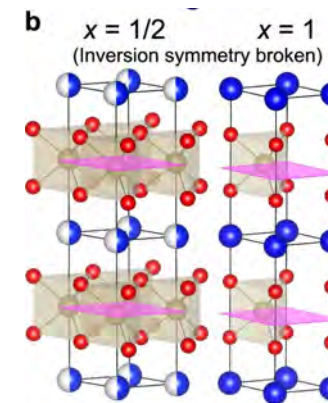
Germanium



Gallium Nitride



Complex Oxide



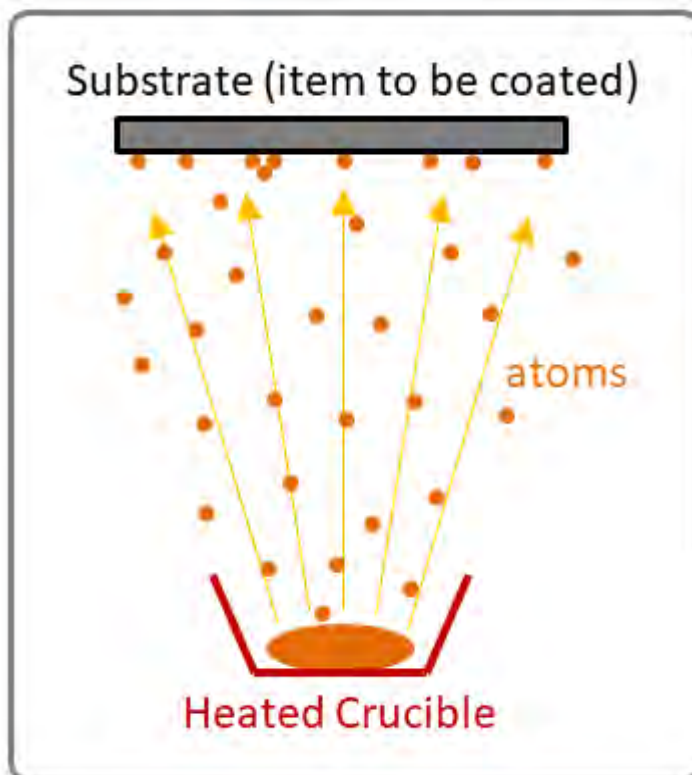
$\text{In}_x\text{TaS}_2$  ( $x = 1/2, 2/3, 1$ )

Intercalated Superconductors

How can we have precise controls of atomic composition, structure, and uniformity?

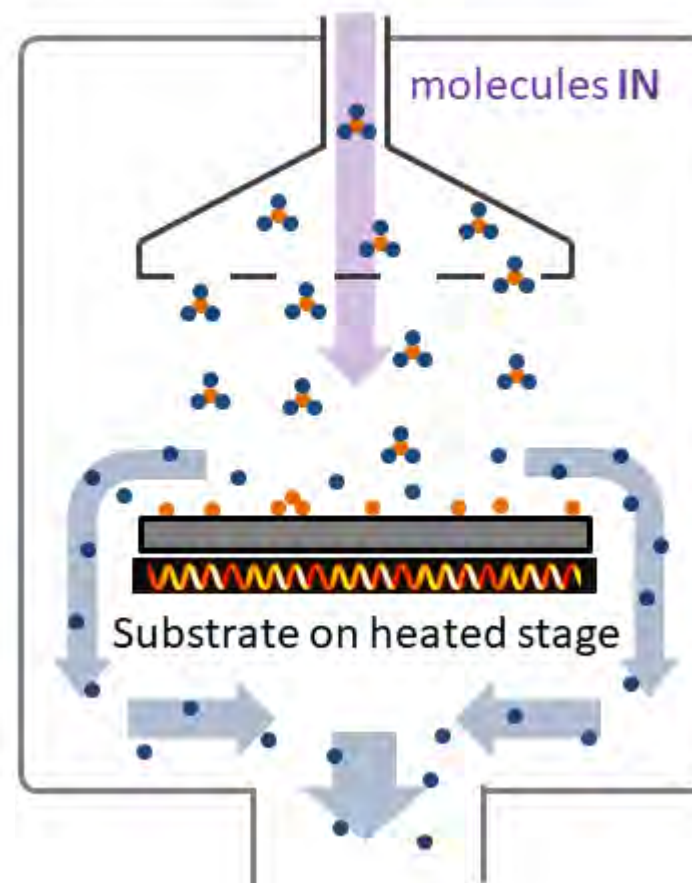
## PVD

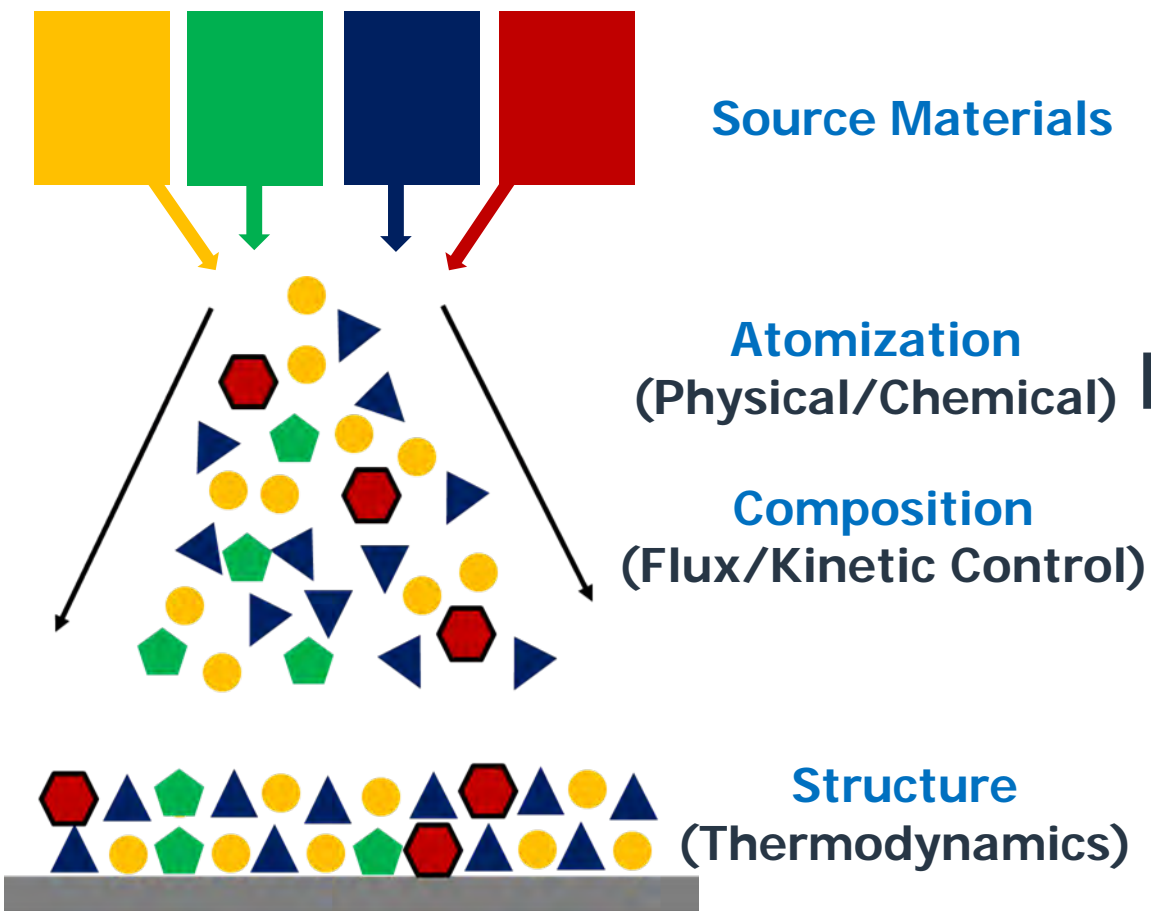
(Physical Vapor Deposition)



## CVD

(Chemical Vapor Deposition)

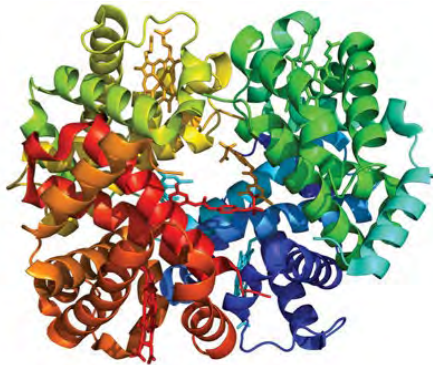




Additional controls and pathways to enable precise composition and structural accuracy of inorganic materials

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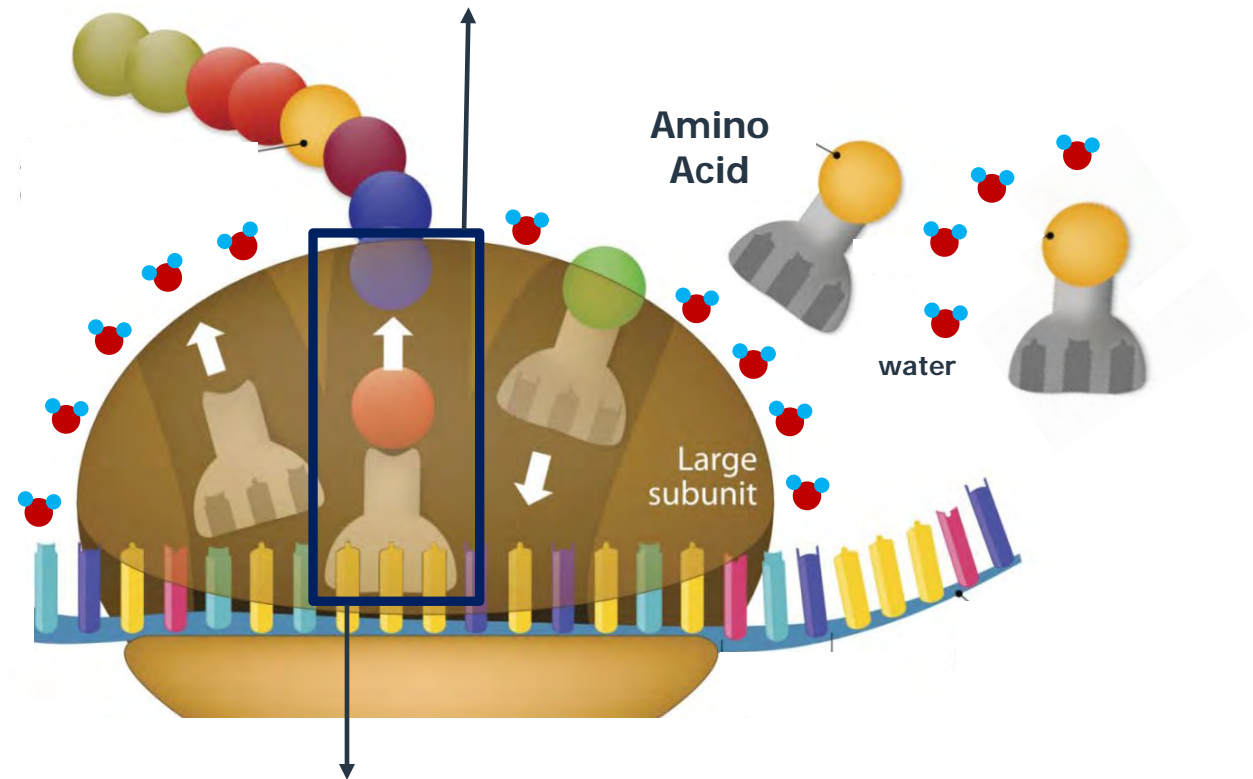
**Protein: Precision controls in Composition and Structure**



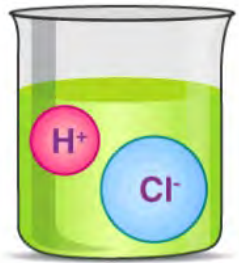
**Desired Properties and Functionalities**

**Localized Thermodynamic and Kinetic Control (water exclusion)**

**Precise Spatial Control**



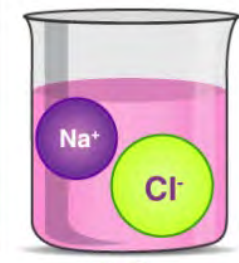
**Simultaneous controls at atomic level are required**



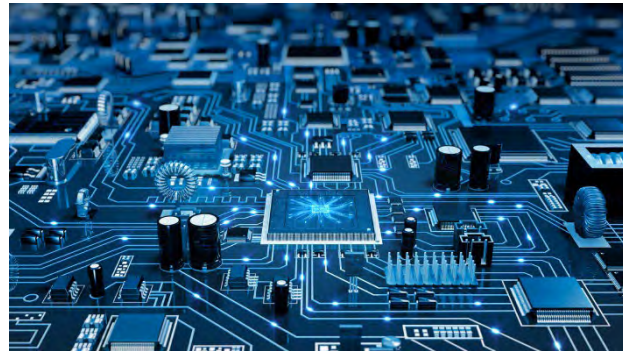
Acid



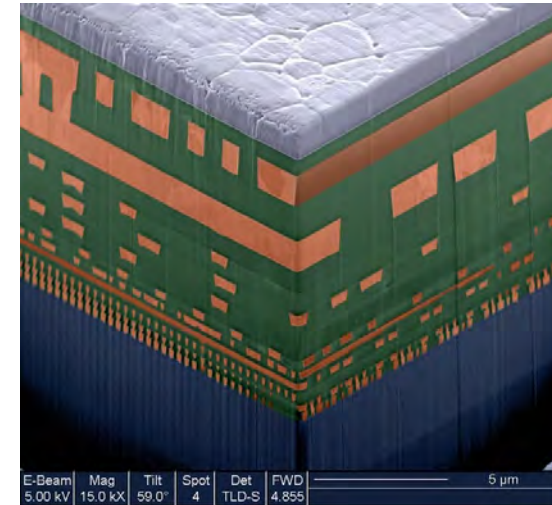
Base



Salt



**Microsystems are vulnerable to environmental threats**



**Chemical corrosions occur at material and material interface**

Building chemical resilience requires both fundamental and integrated approach

## Battlefield medical technology for internal bleeding

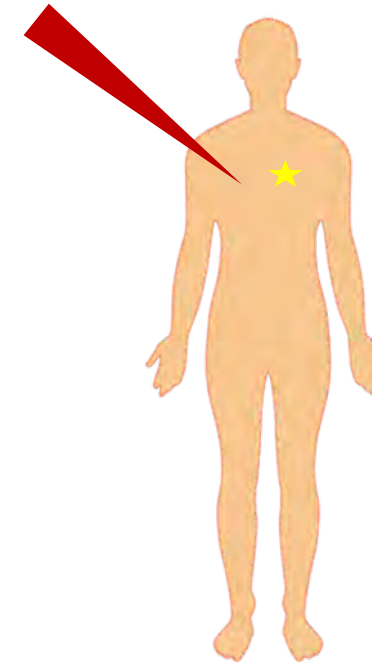


### Internal Bleeding Requires Surgical Procedures

- Constrained Environment
- Restricted Access
- Compressed Timeline

[https://www.army.mil/article/245725/stopping\\_bleeding\\_saves\\_lives\\_on\\_the\\_battlefield](https://www.army.mil/article/245725/stopping_bleeding_saves_lives_on_the_battlefield)

## Focused Non-invasive Energy Delivery



Miniaturized focused energy systems coupled with biological processes

**Stop Internal Bleeding without Surgery**



[www.darpa.mil](http://www.darpa.mil)