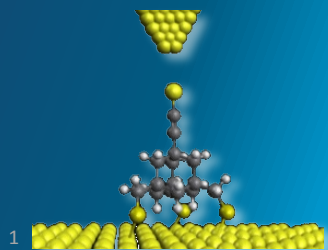


Atomically Precise Manufacturing (APM)

Why are we interested?

Transformative energy efficiency

Direct control of atoms provides far greater efficiency during both the manufacture and end use of products.

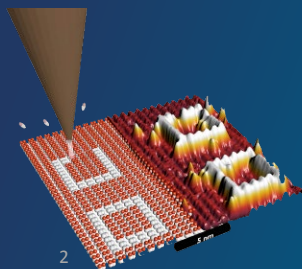


1

Where does research stand today?

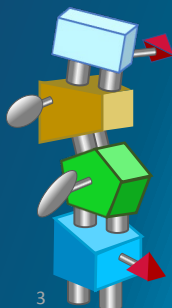
Developing physical, chemical, and biological methods to precisely place and bind each atom into flawless molecules and structures:

- Single atoms on a silicon surface
- Shape-programmable molecules
- Self-assembled nanostructures



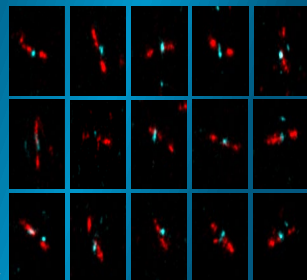
2

STM Lithography
Size: 10 x 10 atoms



3

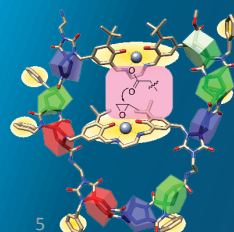
Molecular "Lego"
Size: ~1,000 atoms



4

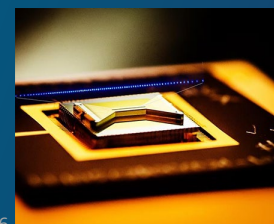
DNA Origami
Size: 500-1,000 atoms

What are the potential future applications?



5

Programmable Catalysts



6

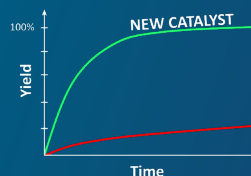
Quantum Electronics



7

High Performance Materials

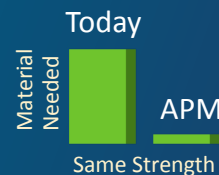
Unprecedented performance



- **Catalysts** that make chemical reactions more than 10 times faster and use a fraction of the energy



- Next-generation **electronics** made with 100 to 1,000 times less embodied energy



- The opportunity for lighter and stronger **materials**—ten times stronger per pound than today's best.

AMO research investments:

\$18.2 million in grants to universities and small businesses

October 2019
www.energy.gov/amo

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