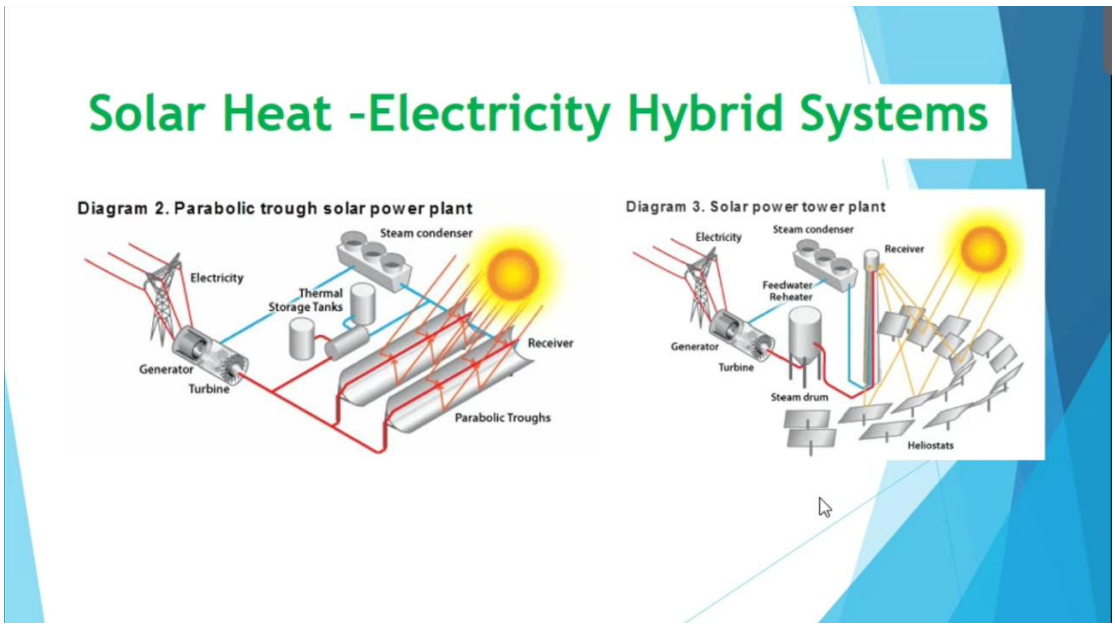
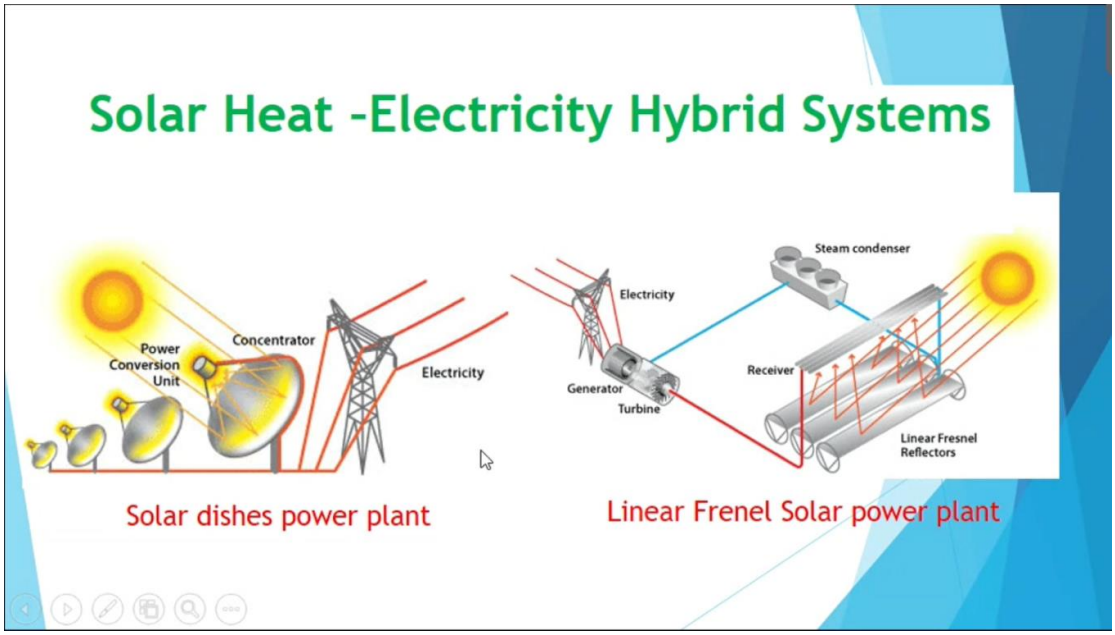
Hybrid renewable energy storage system

Steady and continuous

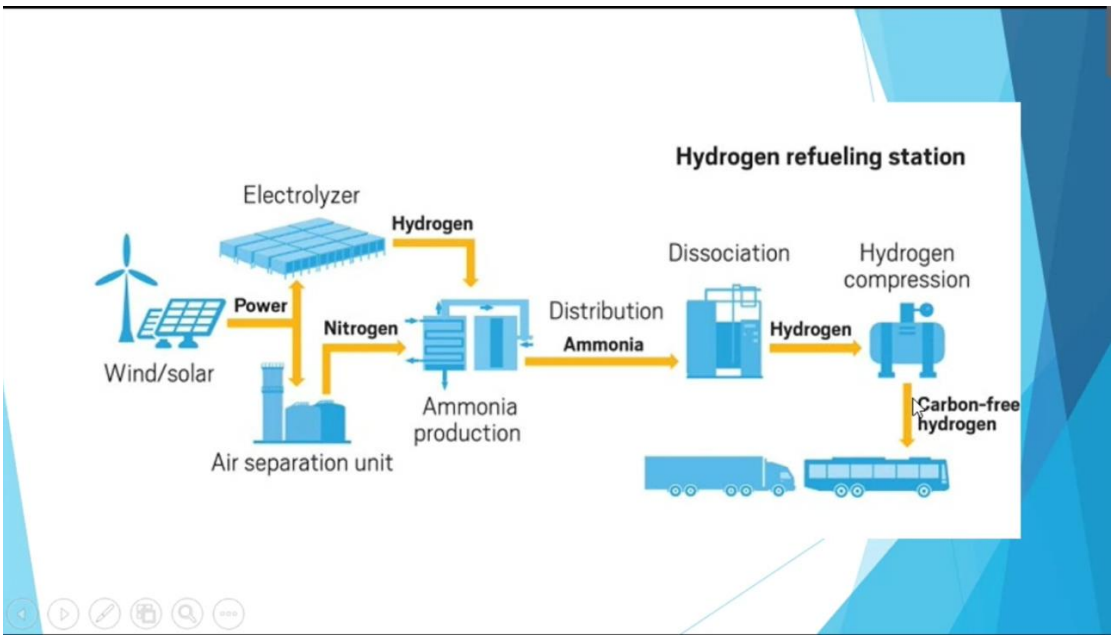
0. There are four types to product solar heat and transport into electricity power system directly.



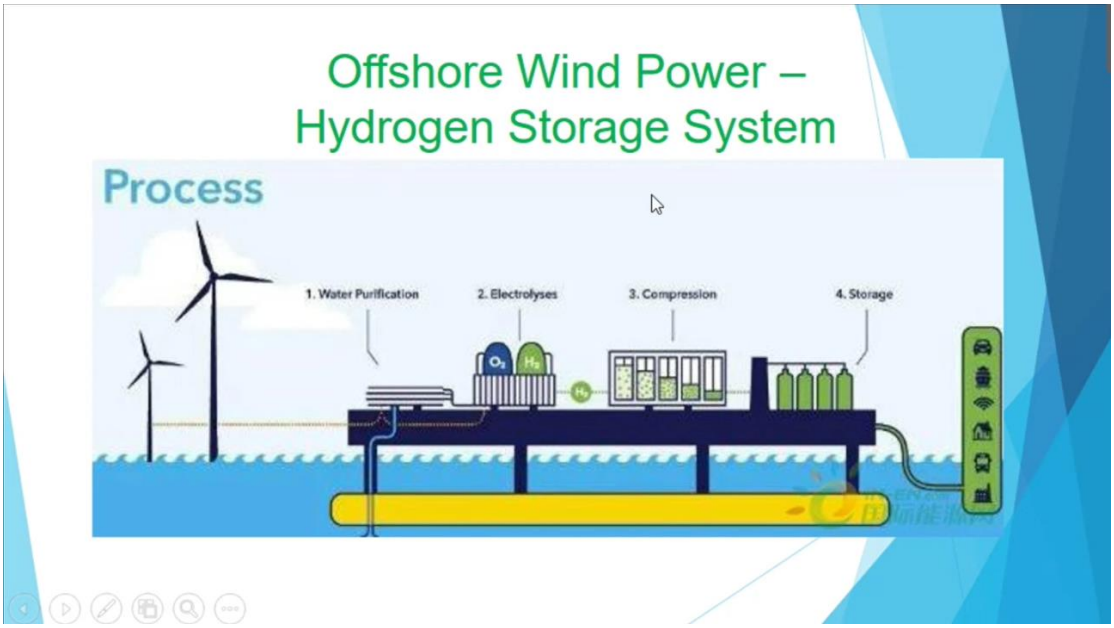


But in somewhere, there aren't having power system, so some people think the solar power can be

transform into Hydrogen gas. Using solar power make the electrolyzer product hydrogen, and storge in tank with high pressure.It easy to storge, low pollution and cheap, can be used on bus, truck, mobile, etc.

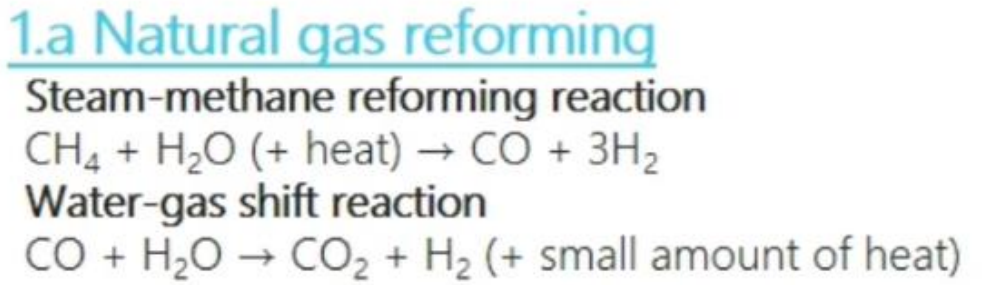


Or use wind power to product hydrogen on the sea.

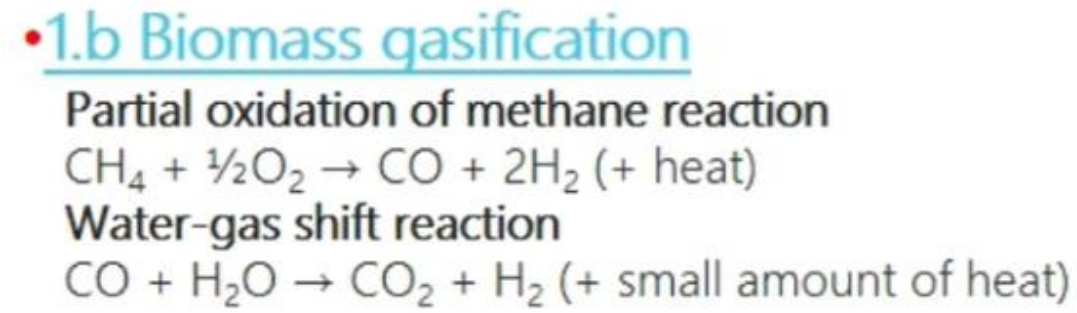


1. Thermochemical process:

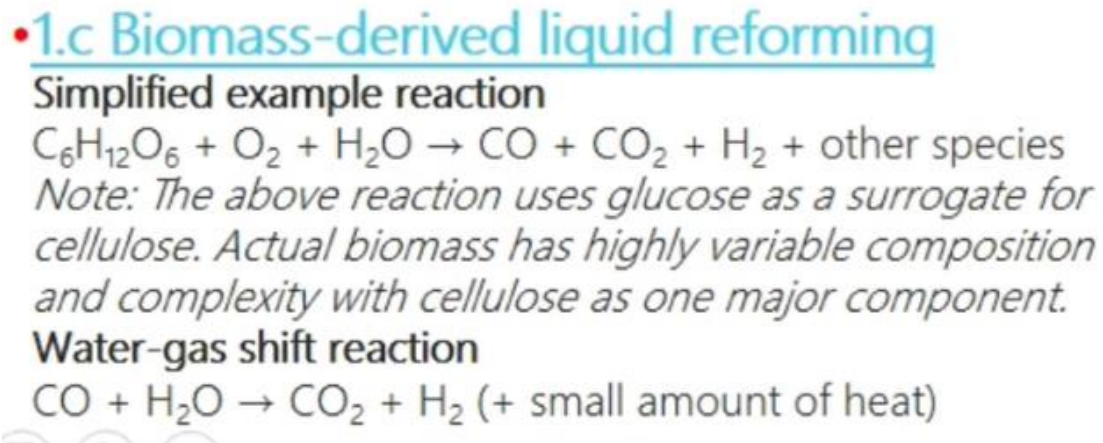
(1) Natural gas refoeming



(2) Biomass gasification



(3) Biomass-derived liquid reforming



(4) Solar thermochemical hydrogen (STCH)

•1.d Solar thermochemical hydrogen (STCH).

Steam reforming reaction (ethanol)

$C_2H_5OH + H_2O$ (+ heat) → $2CO + 4H_2$

Water-gas shift reaction

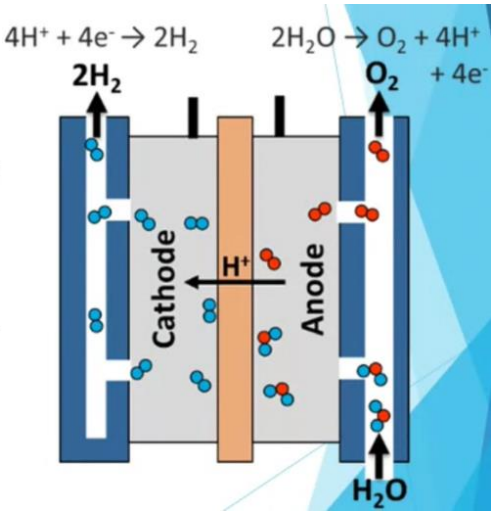
$CO + H_2O \rightarrow CO_2 + H_2$ (+ small amount of heat)

2. Electrolytic process

Electrolyzers use electricity to split water into hydrogen and oxygen. This technology is well developed and available commercially, and systems that can efficiently use intermittent renewable power are being developed. Learn more about electrolysis.

Anode Reaction: $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

Cathode Reaction: $4H^+ + 4e^- \rightarrow 2H_2$



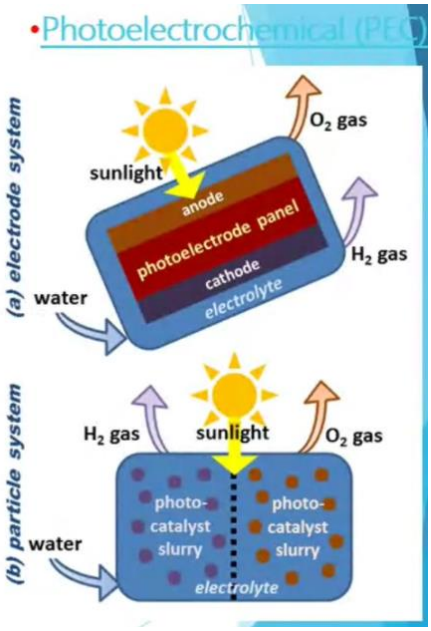
3. Direct Solar Water Splitting Process

Direct solar water splitting, or photolytic, processes use light energy to split water into hydrogen and oxygen. These processes are currently in various early stages of research but offer long-term potential for sustainable hydrogen production with low environmental impact. Learn more about the following solar water splitting processes:

•Photoelectrochemical (PEC)
•Photobiological.

•Photobiological.

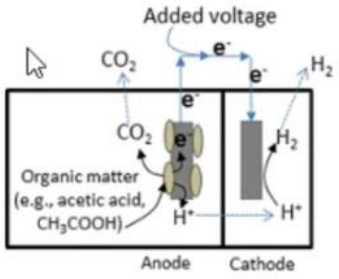
In photolytic biological systems, microorganisms—such as green microalgae or cyanobacteria—use sunlight to split water into oxygen and hydrogen ions. The hydrogen ions can be combined through direct or indirect routes and released as hydrogen gas



4. Biological Process

Microbes such as bacteria and microalgae can produce hydrogen through biological reactions, using sunlight or organic matter. These technology pathways are in the research and development stage, with pilot demonstrations occurring, but in the long term have the potential for sustainable, low-carbon hydrogen production. Learn more about the following biological processes:

- Microbial biomass conversion
- Photobiologi



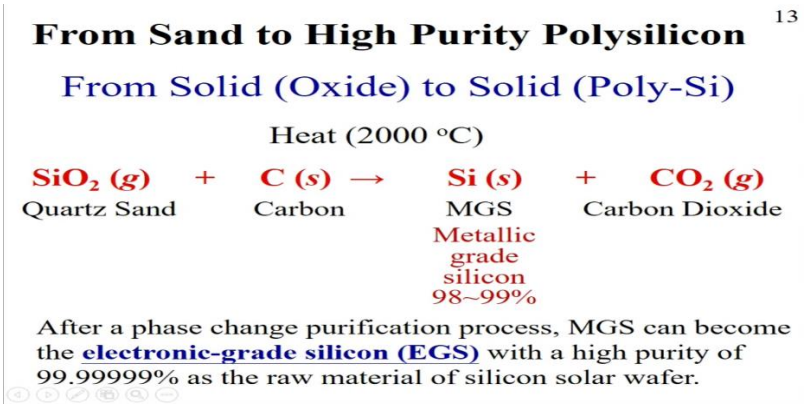
Crystalline Silicon Solar Cell Production:

From Silicon Wafer to Cell

From poly-Si to PV system

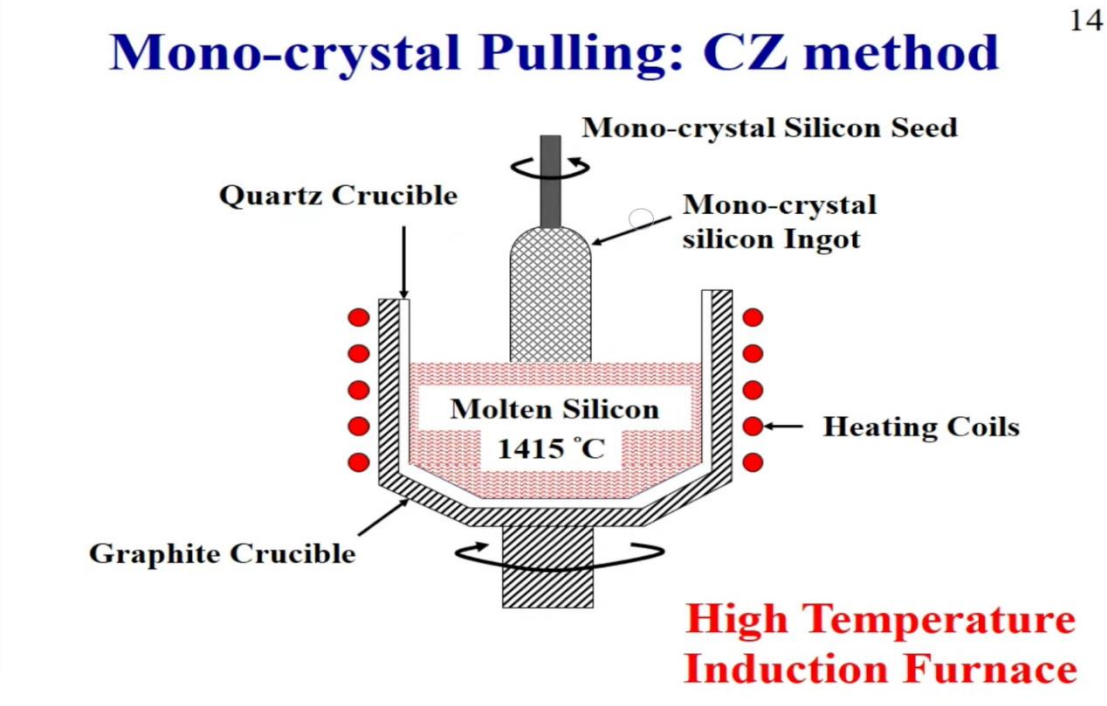
1. Why use Silicon? In the crust, the most element is Si, so acturlly the Si is the cheapest matal.
2. The process:

   (1) From sand to high purity polysilicon

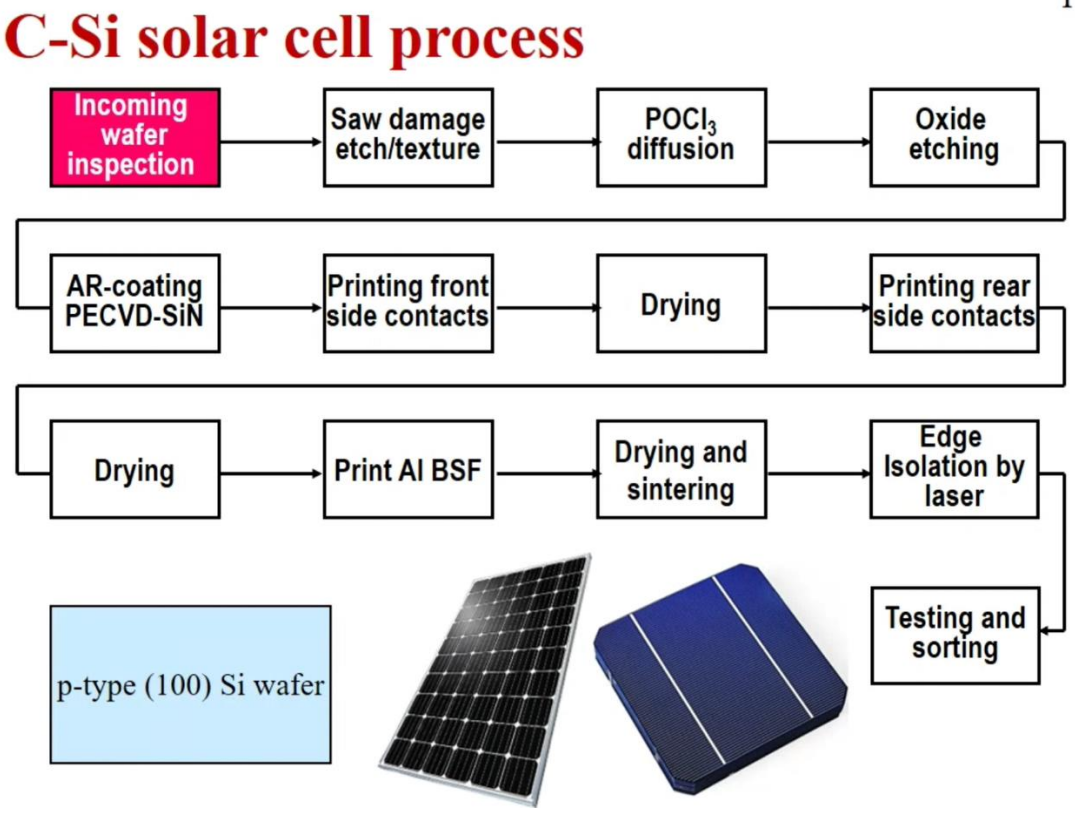


(2) Mono-crystal pulling: CZ method

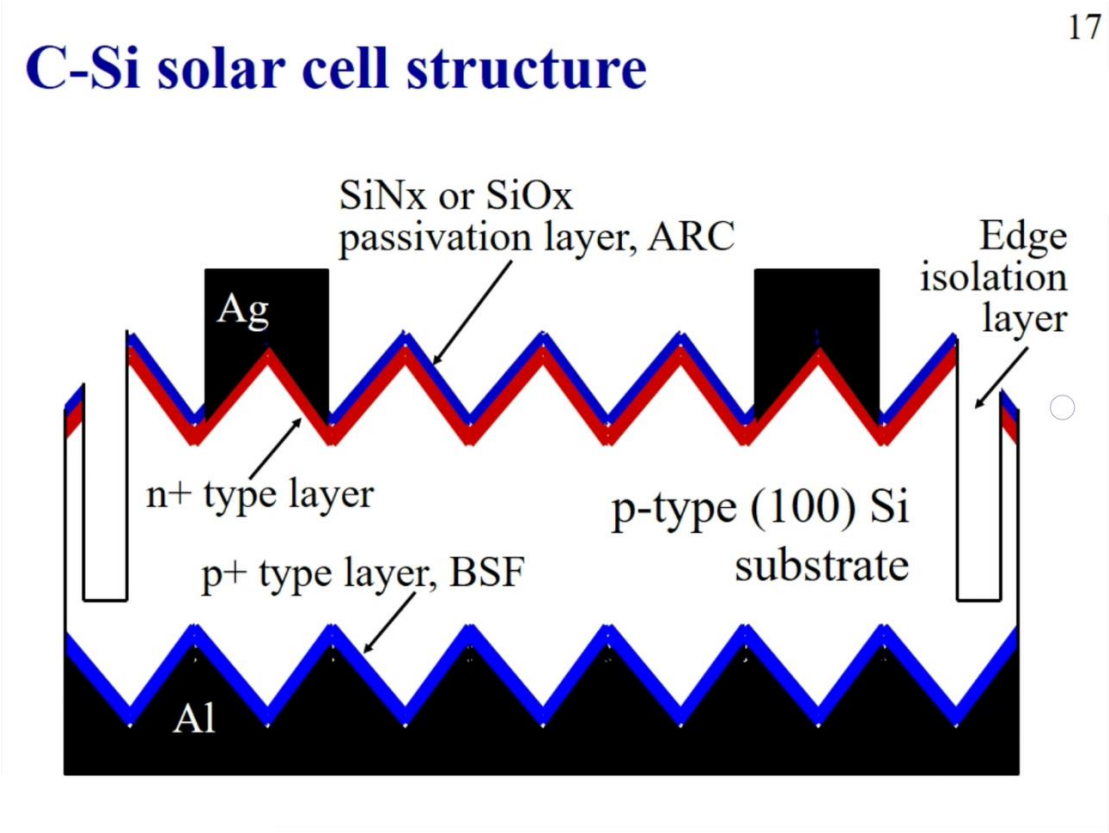
By slow rotation 4~7days, we can get silicon ingot



(3) Cell process:

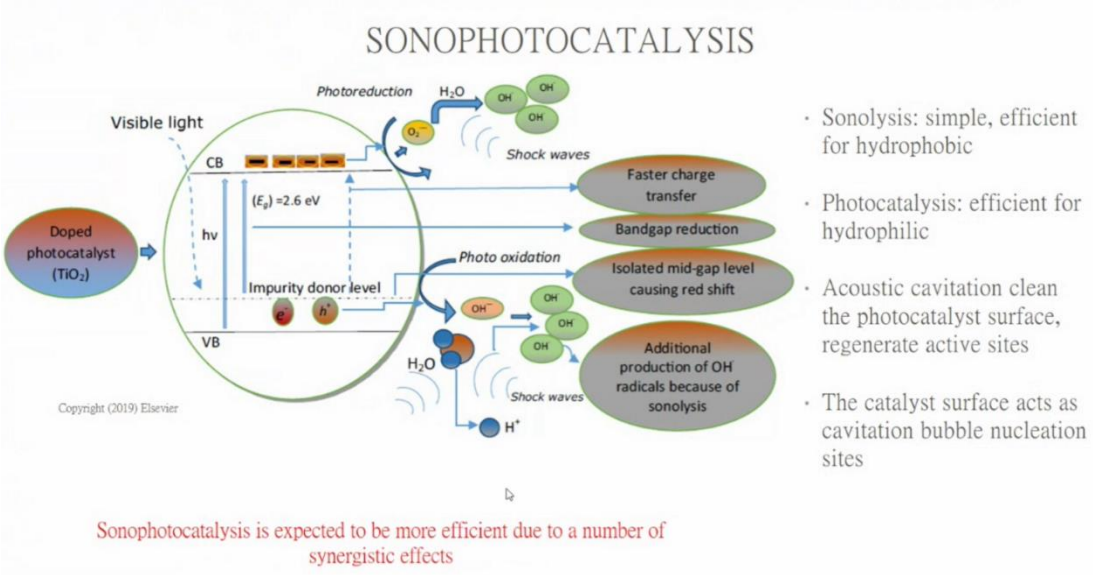


3. C-Si solar cell structure

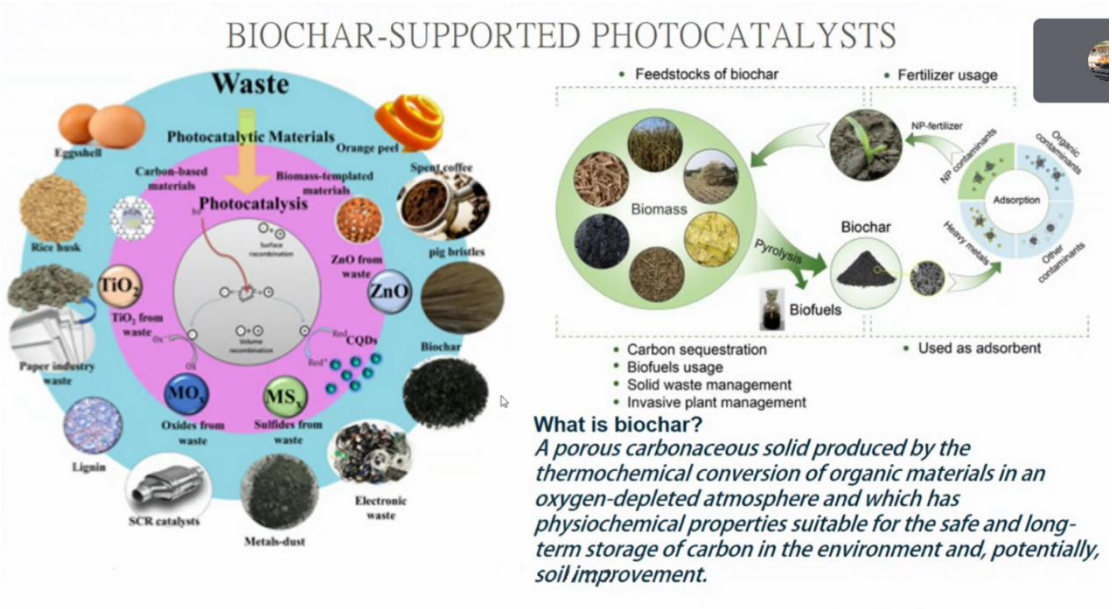


Sonophotocatalysis

1. Sonophotocatalysis



2. Biochar-supported photocatalysts



3. Role of biochar in biochar-supported photocatalysts and photocatalysis