



Perovskite Solar Cells

ET - 1039. Nanotechnology

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Index

1. What is perovskite
2. Advantages
3. Disadvantages
4. Future objectives
5. Applications

1. What is perovskite?

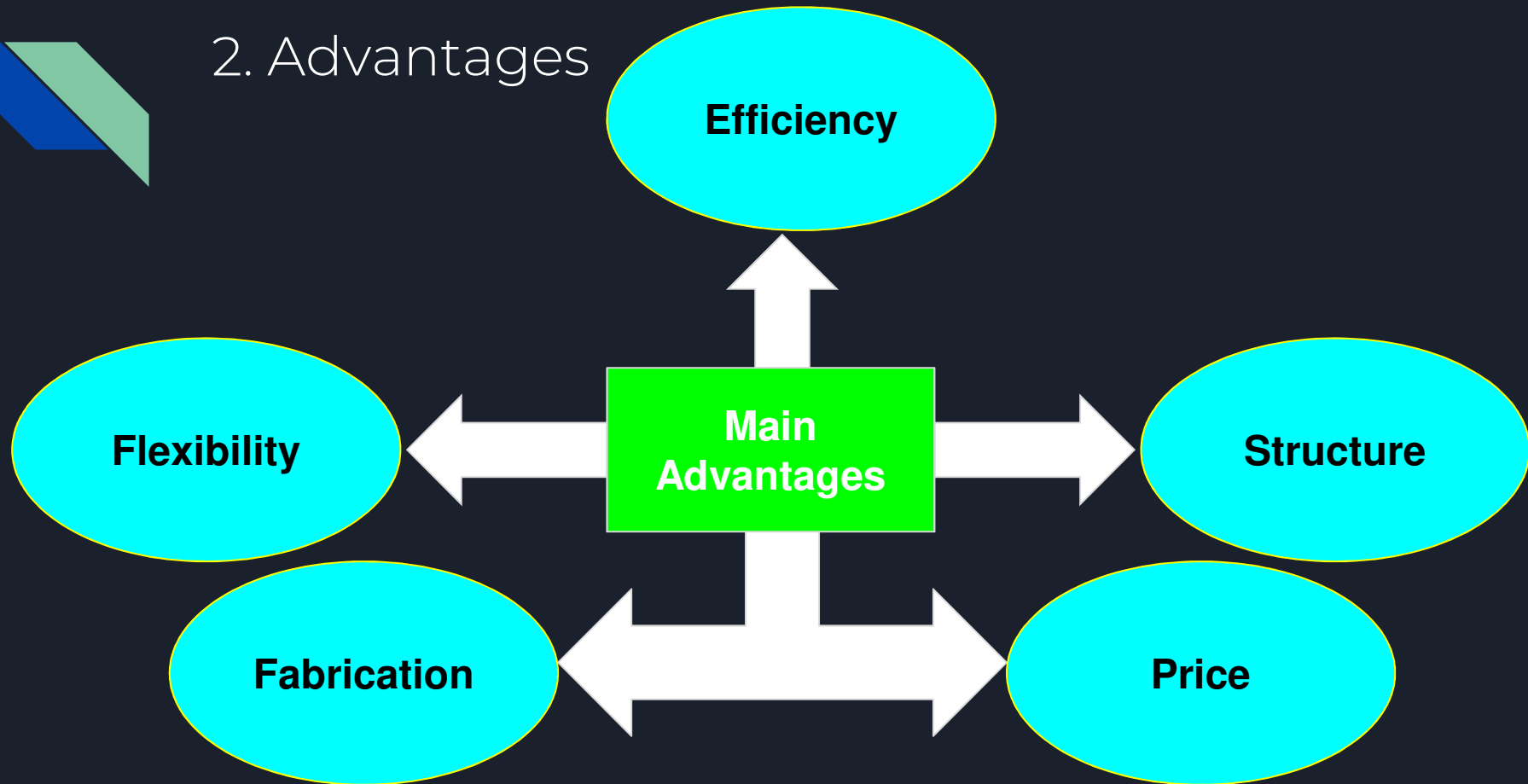


The perovskite was discovered in 1839, by Lev Perovskiy (CaTiO_3).

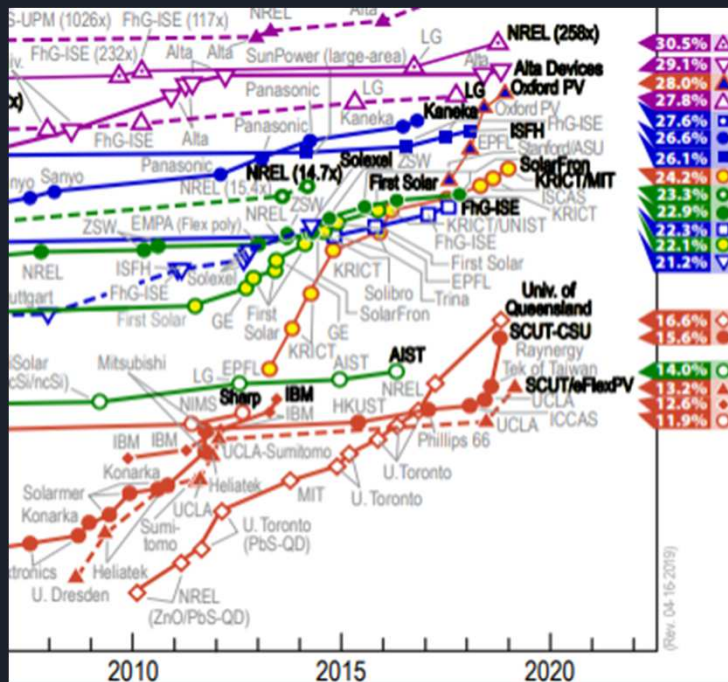
Perovskite is a crystalline structure, that can be formed by many materials.

Combination of materials provides good absorption properties.

2. Advantages



2. Advantages. Efficiency



Perovskite Solar Cells Efficiency:

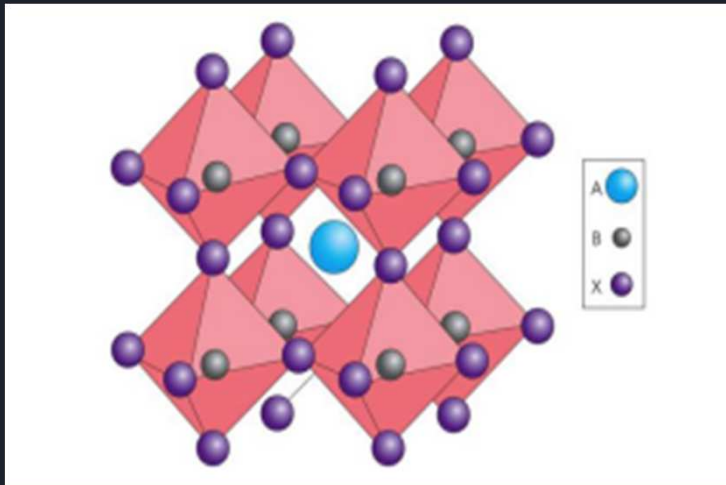
- In 2009 -> 3,8 %
- In 2019 -> 24,2 %

Silicon solar cells only have incremented a 1,6% since 2012

Tandem Solar Cells (Perovskite over silicon solar cells):

- In 2019 -> 28,0 %

2. Advantages. Composition and structure



The most common composition is formed by lead halide and methylammonium with:

- Bromine (MAPbBr₃)
- Iodide (MAPbI₃)

Structure: ABX₃

- A: organic or inorganic compound
- B: metal
- X: halide (I, Br or Cl)

2. Advantages. Low cost



Silicon solar cells:

- 56 c€ / W

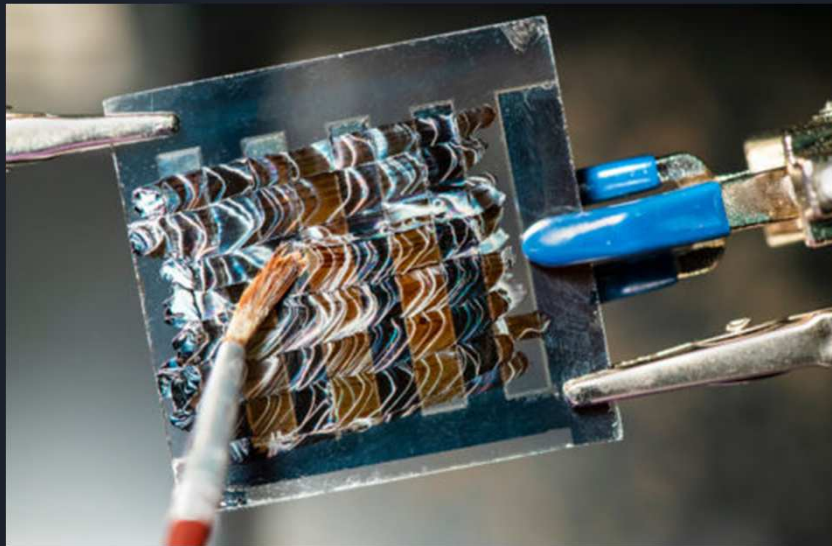
Perovskite Solar Cells:

- 7,5 - 15 c€ / W

Difference in 1 MW installation:

SSC: 600.000,00	}	410.000,00
PSC: 150.000,00		

2. Advantages. Easily fabricable

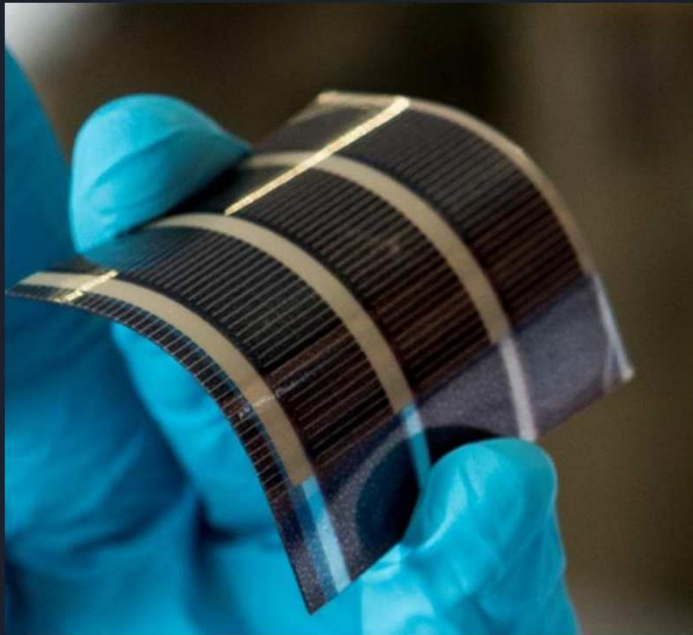


Most common methods:

- depositing chemicals
- spin-coating
- spraying
- painting

Less fabrication temperature (200°C) than silicon (900°C).

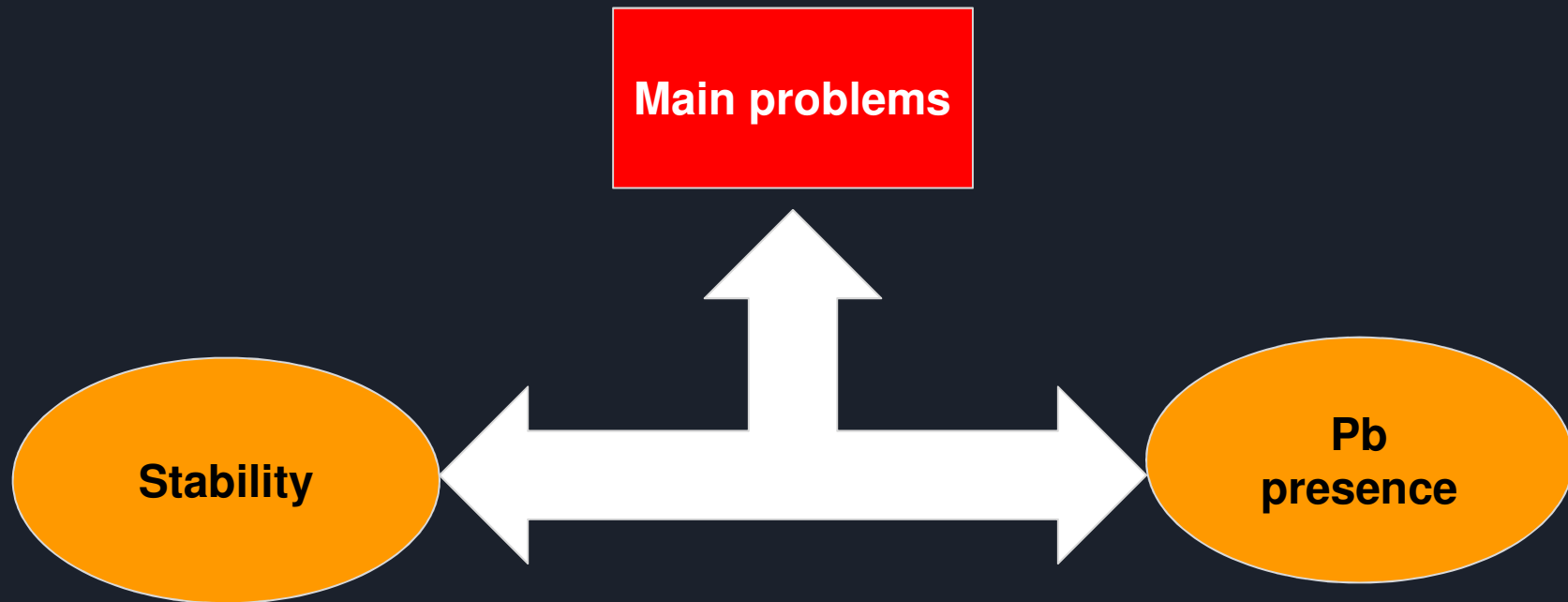
2. Advantages. Flexibility and lightweight



The different process of fabrication of Perovskite Solar Cells allow, films around 1 micron.

This allow more applications than Silicon Solar Cells, working over many surfaces and more resistant to vibration.

3. Disadvantages





3. Disadvantages. Stability

Stability problems are a consequence of different causers:

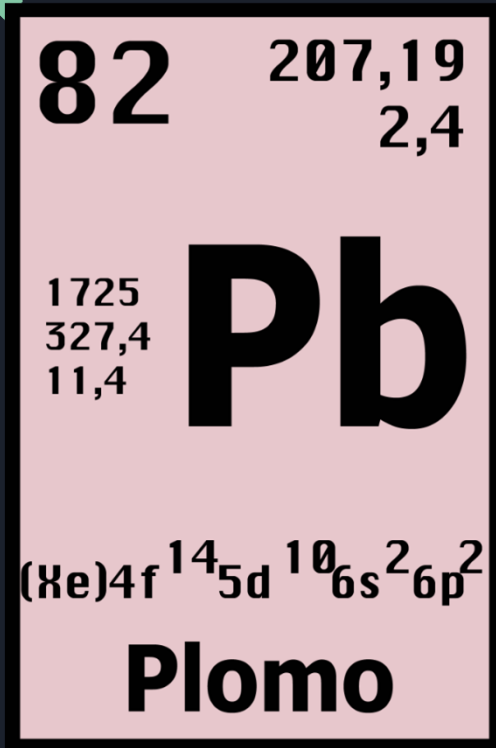
1. Moisture
2. UV rays
3. Temperature
4. Internal migration of ions

Perovskite is not capable
to resist without
degrading:



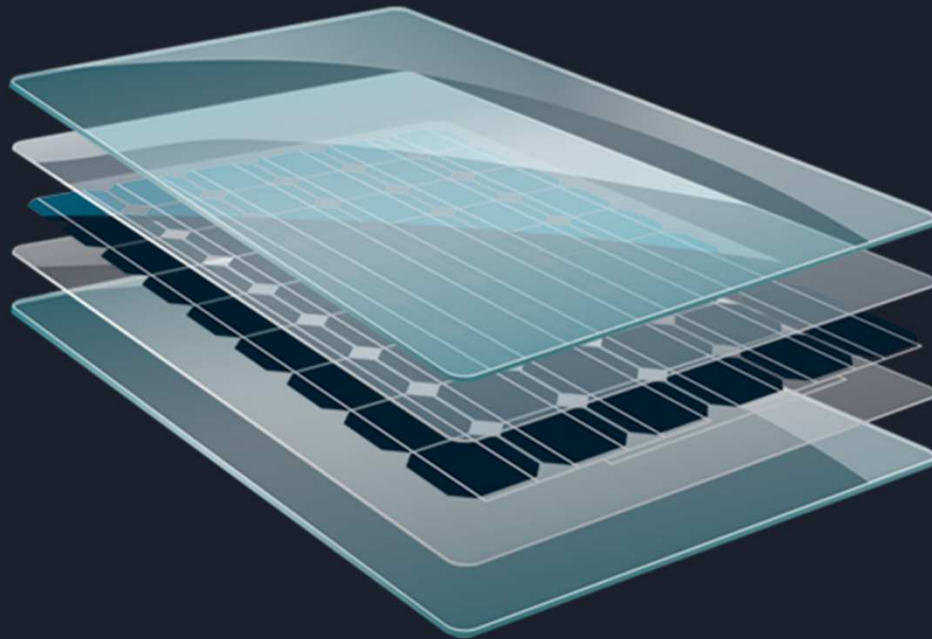
**Efficiency
losses**

3. Disadvantages. Pb presence



- Every time the perovskite suffers from degradation, the main substance that gets separated is Pb.
- Pb supposes a big problem for environment
- Solutions : good encapsulation

4. Future objectives: Encapsulation



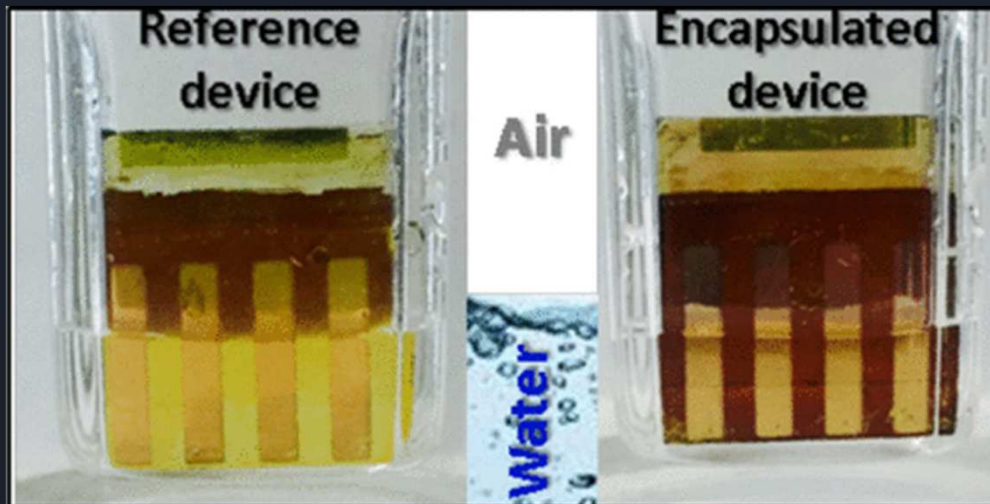
Different procedures studied has not worked well.

Encapsulating is the alternative.

Some methods:

- Carbon nanotubes
- Al₂O₃
- Glass barrier

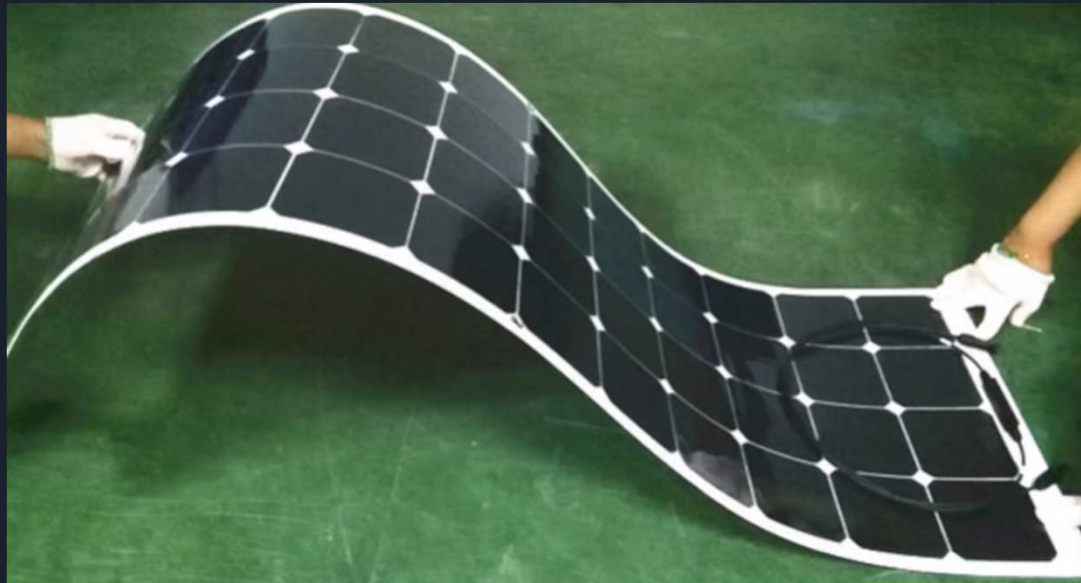
4. Future objectives: Encapsulation



“Enhancing Moisture and Water Resistance in Perovskite Solar Cells by Encapsulation with Ultrathin Plasma Polymers” by CSIC-University of Sevilla

With a relative humidity of 30-60%, for 30 days the degradation of the encapsulated perovskite solar cell was observed to be very low compared to that which was not encapsulated.

5. Future applications




5. Future applications



5. Future applications





Thanks for your attention, any
question?