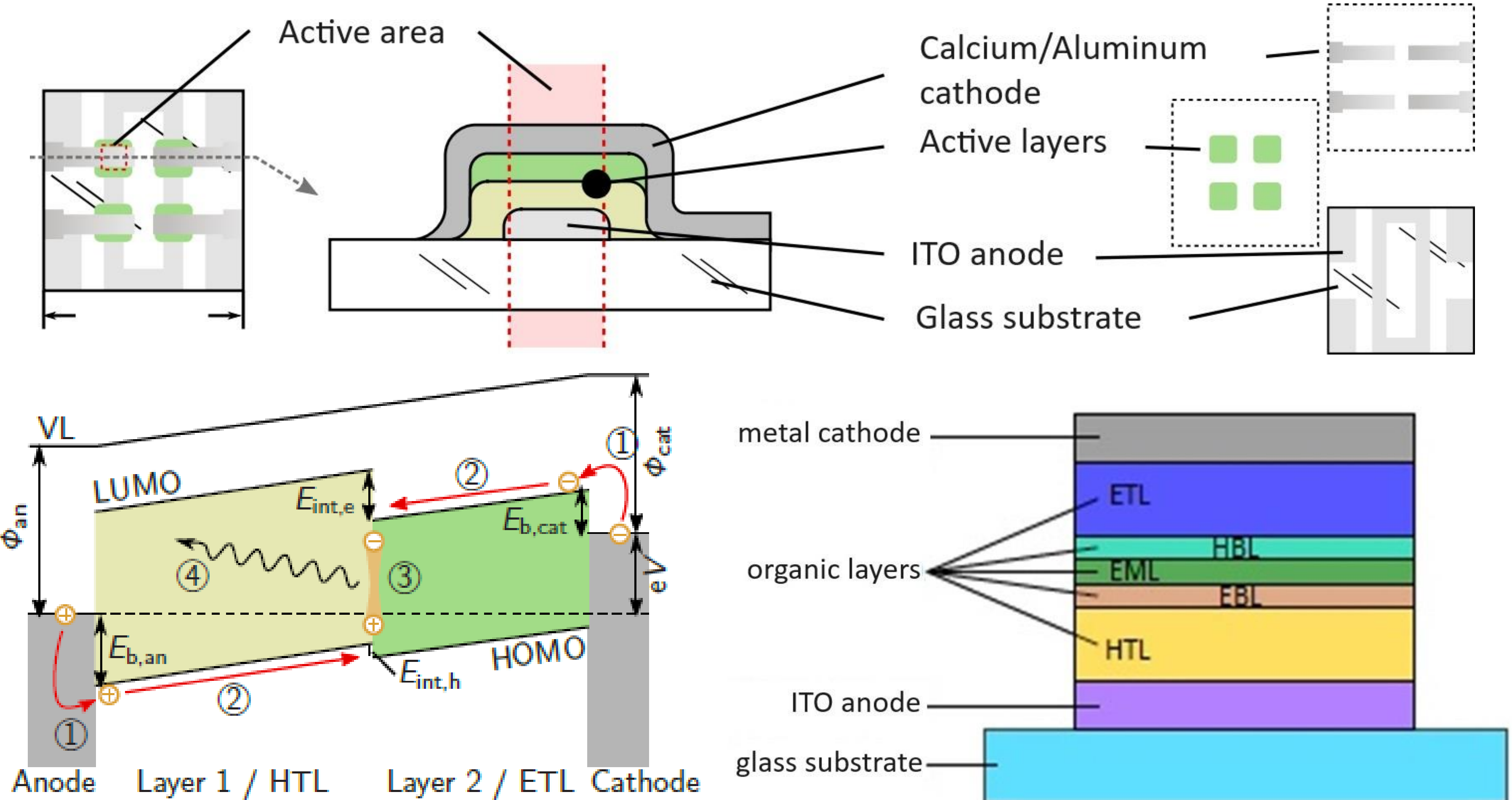


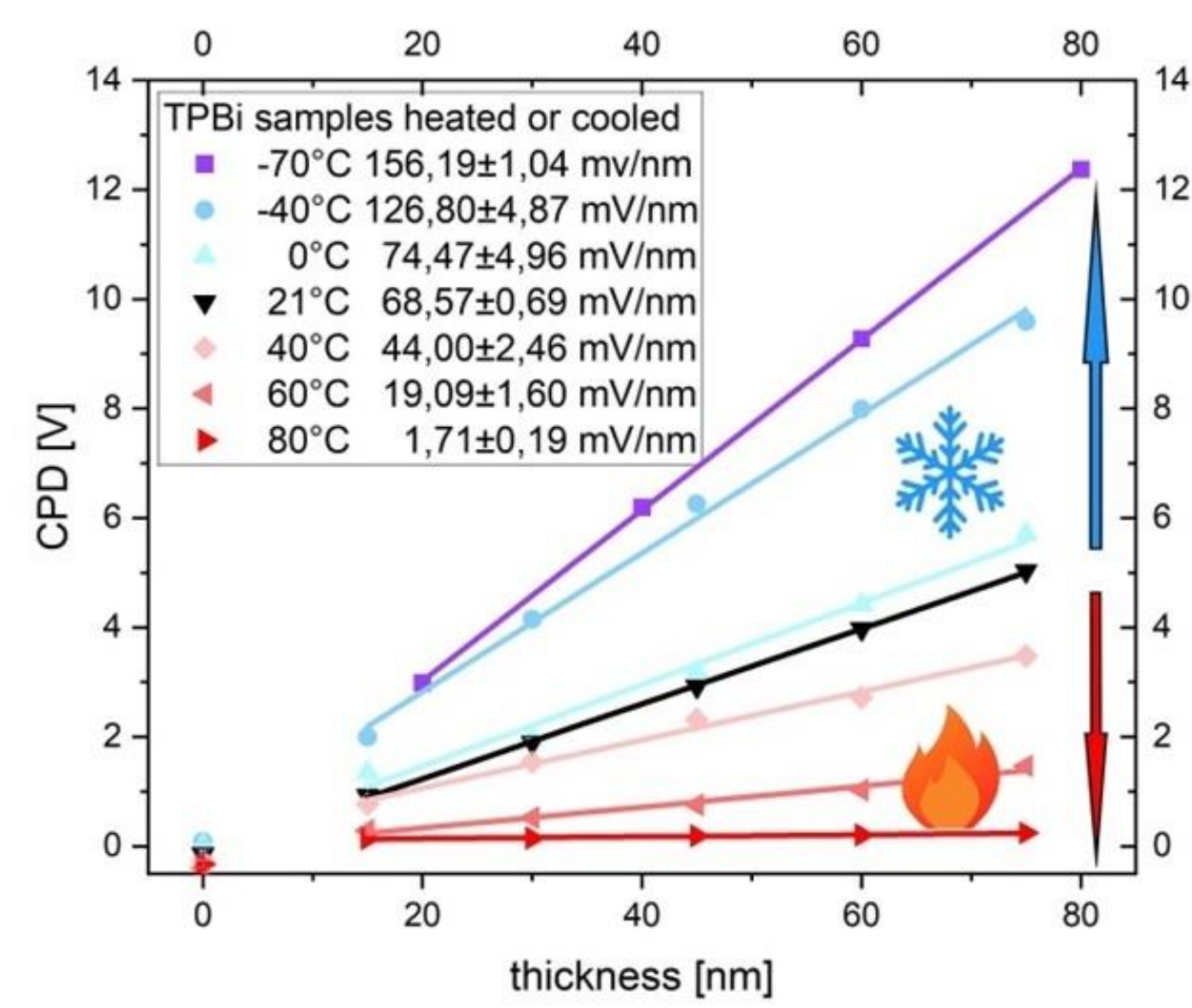
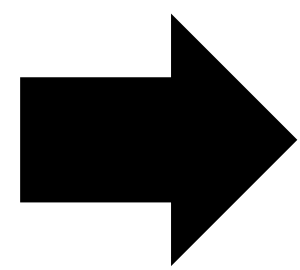
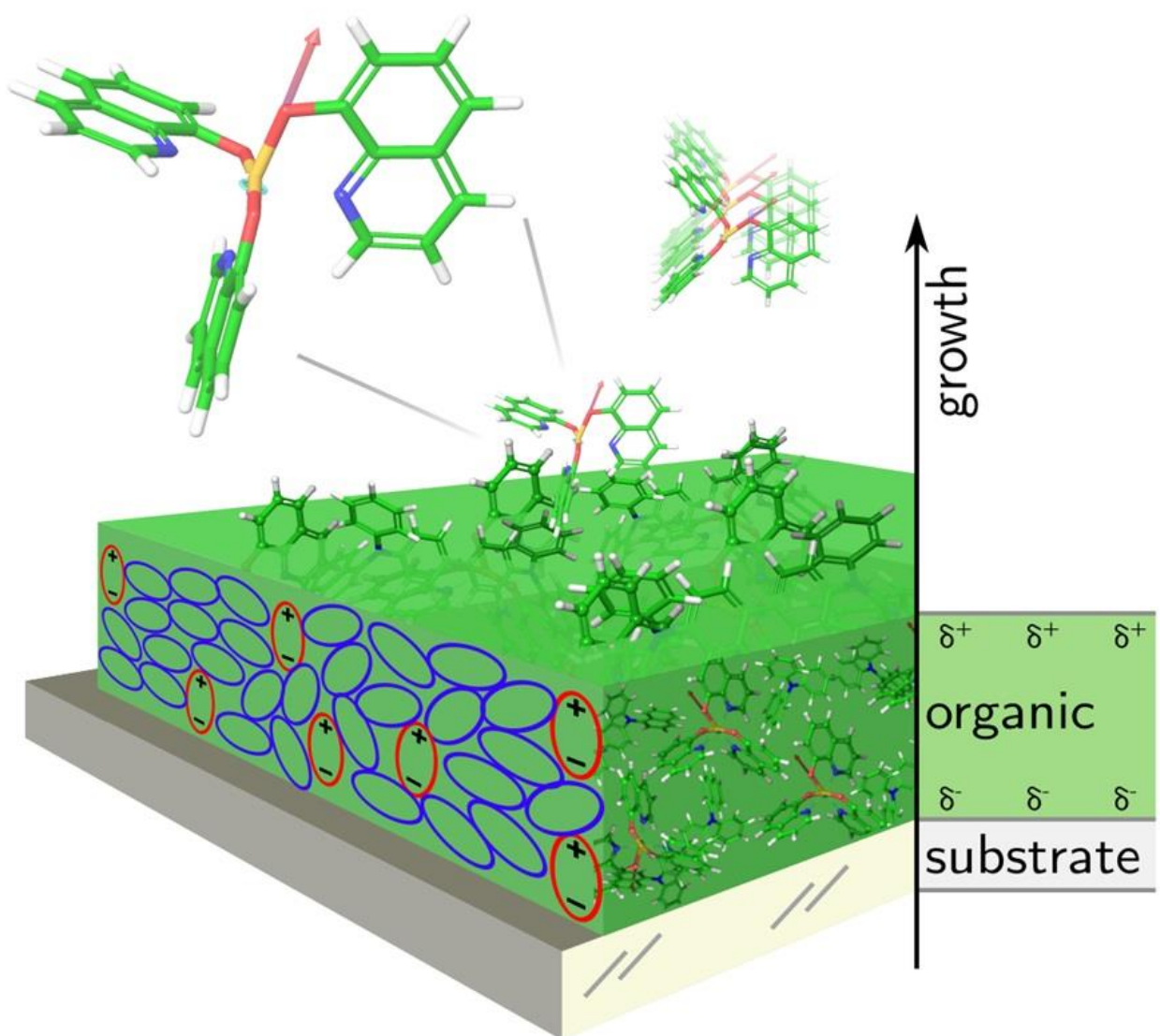
## Organic semiconductor

- Film-preparation from solution (Spin-Coating) or vapor phase (Physical Vapor Deposition)
- Low-weight organic molecules and high-molecular weight polymers
- Common applications: Organic light-emitting diodes (OLEDs), organic photovoltaic cells (OPVs), Organic field-effect transistors (OFETs)
- Flexible choice of the substrate (transparent or even human skin)
- Cheap device fabrication and high flexibility in the design of the structures



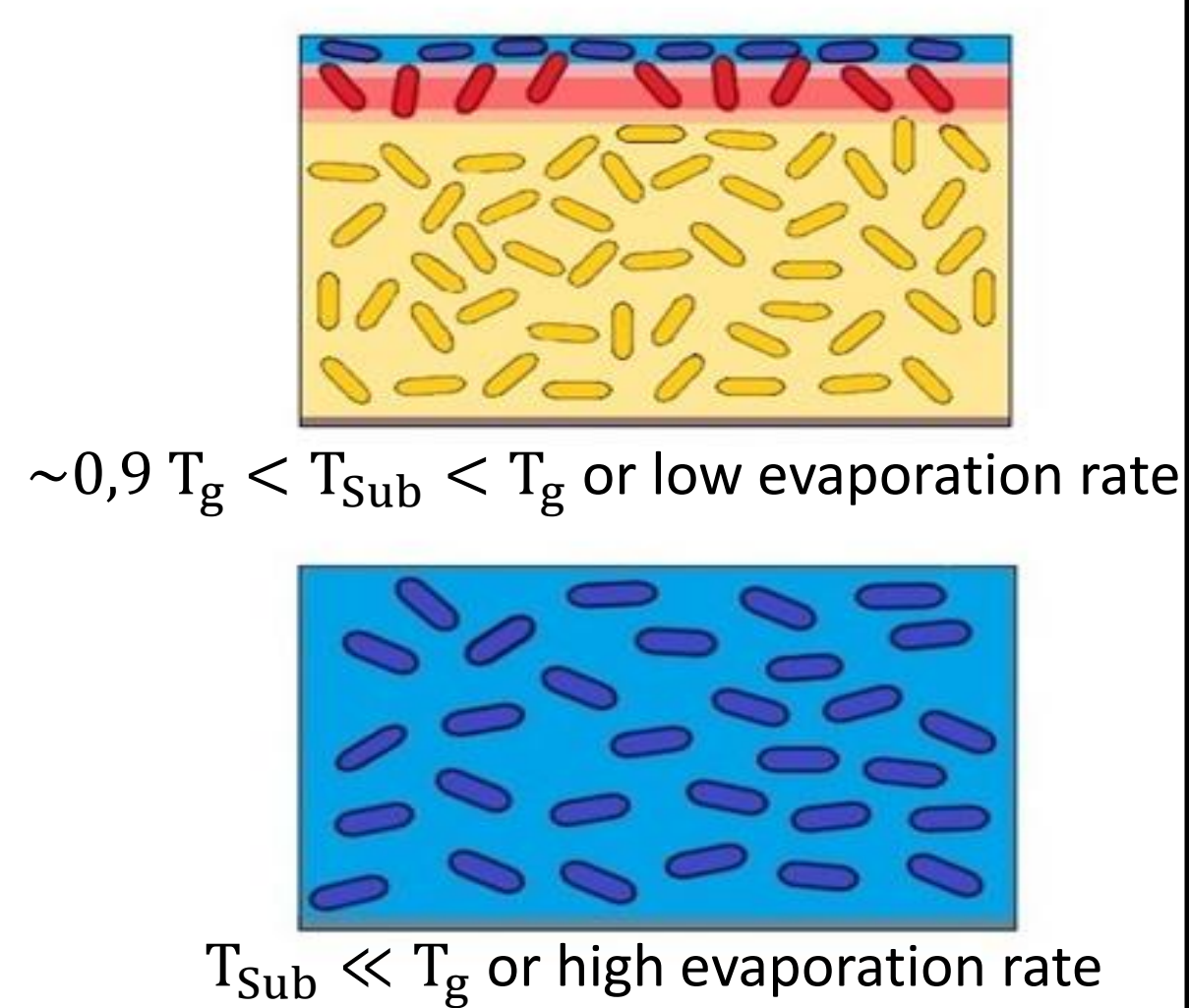
## Molecular orientation in organic thin films

### Orientation of the Permanent electrical Dipole Moment (PDM)

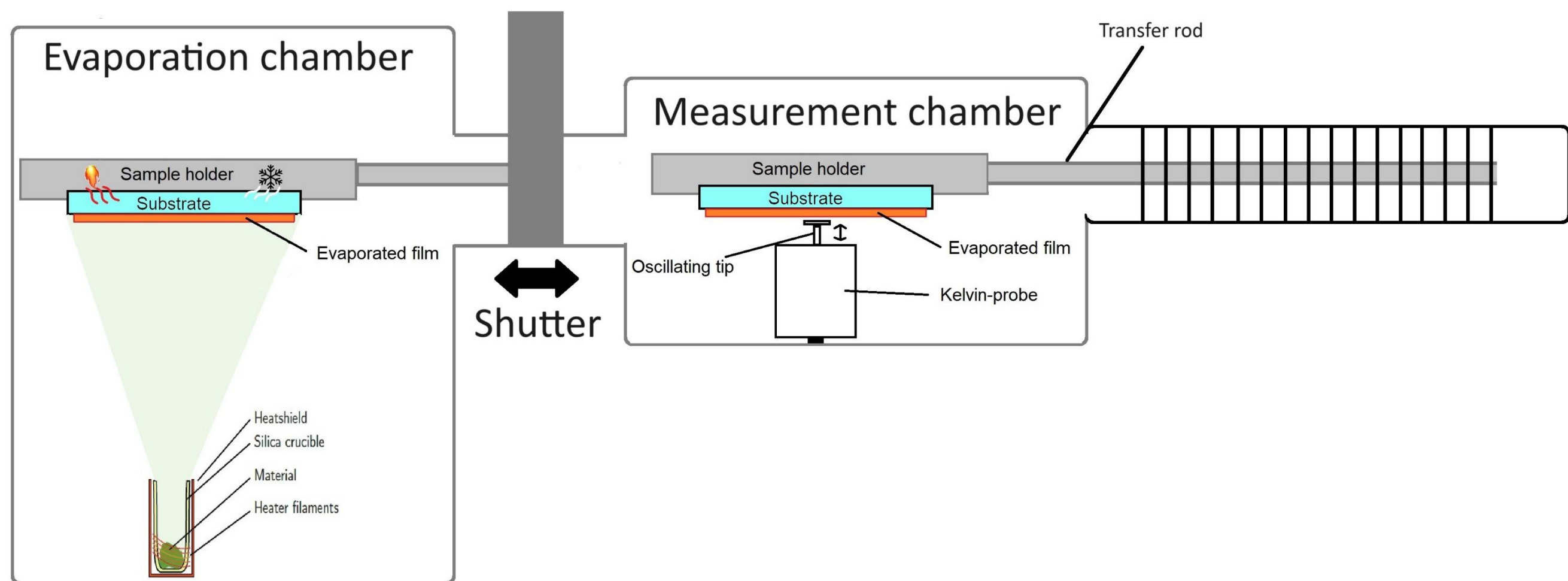


Spontaneous orientation polarization (SOP) causing an internal electric field by PDM alignment:

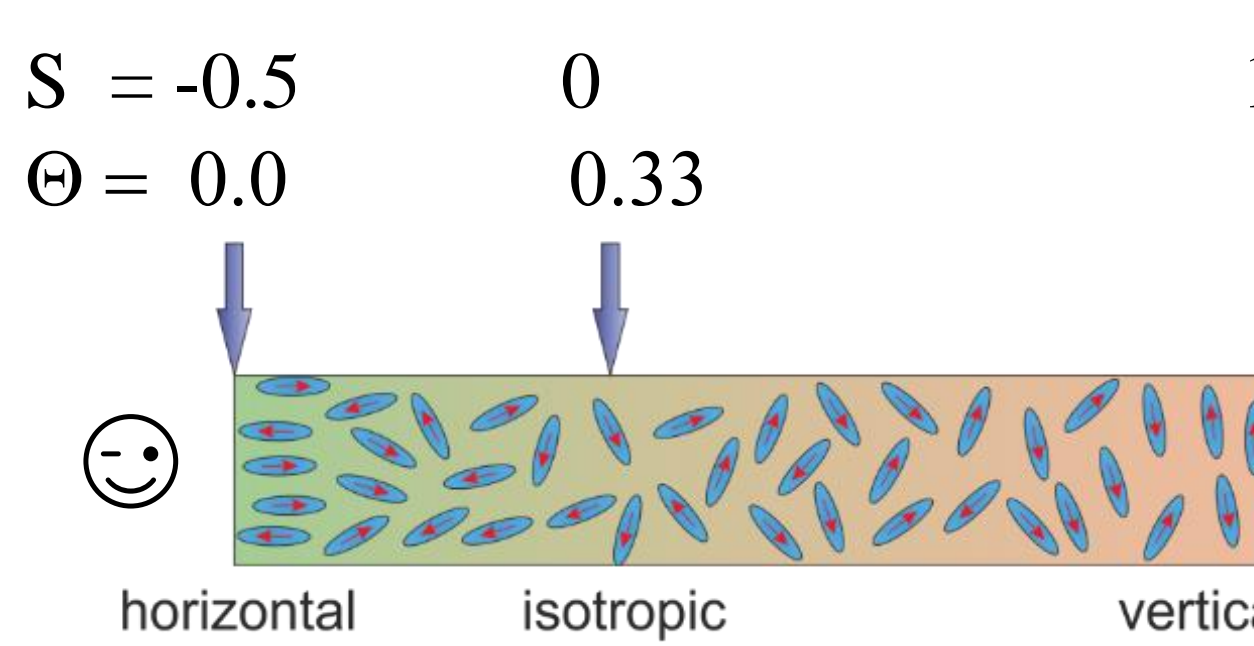
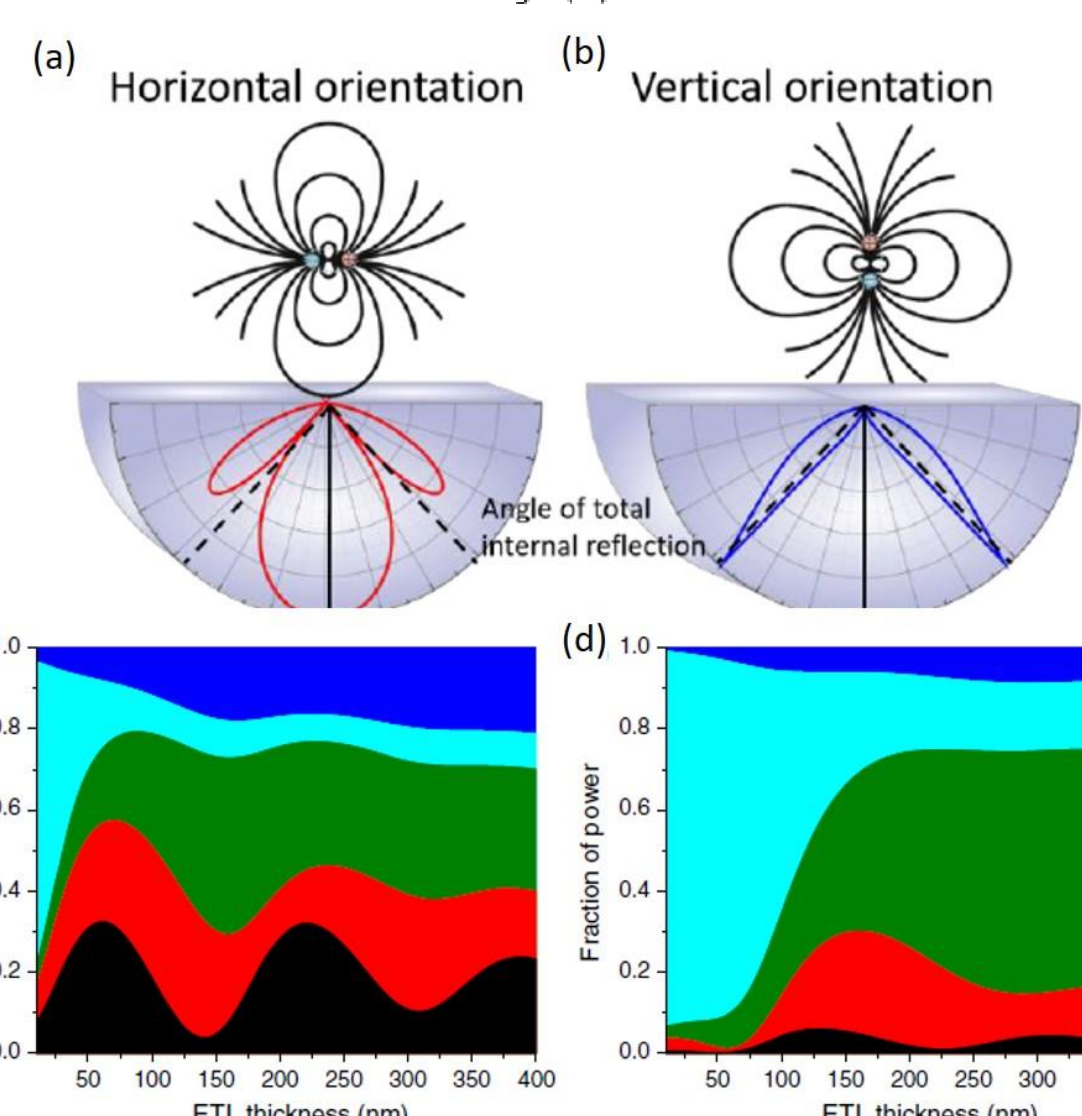
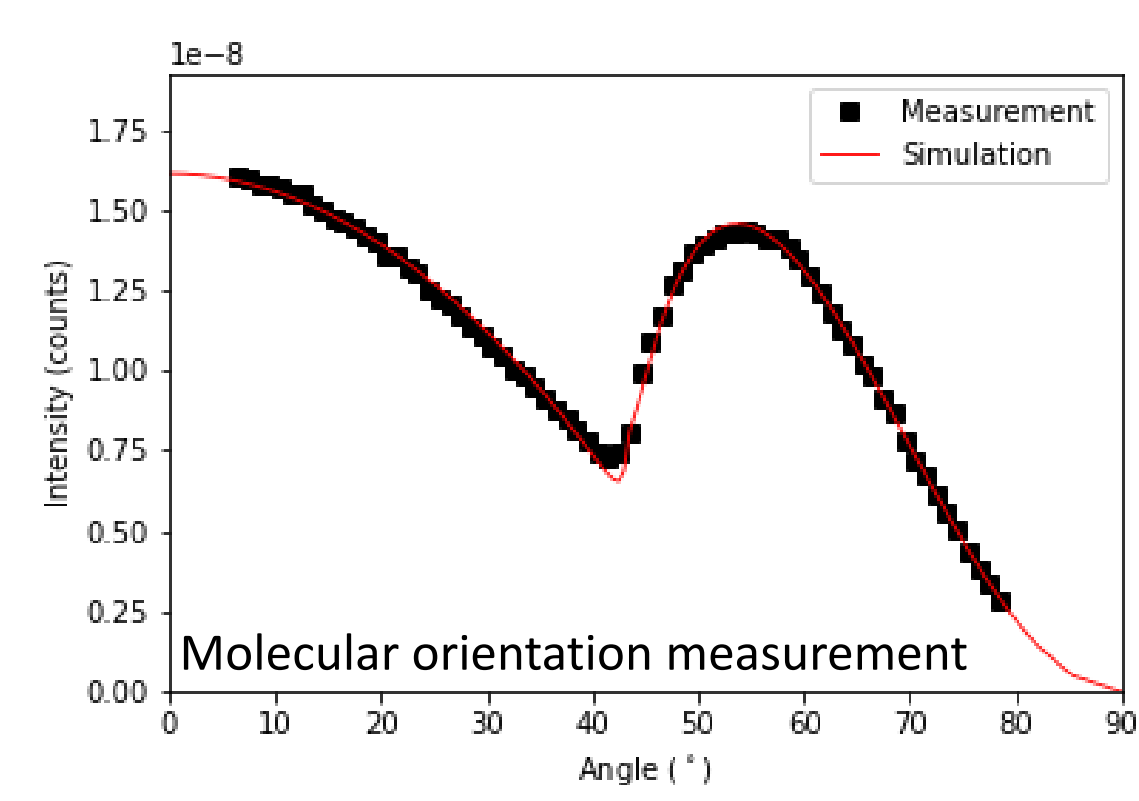
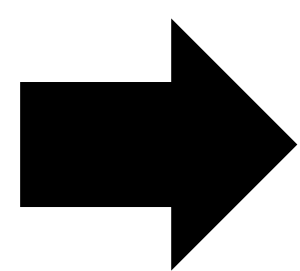
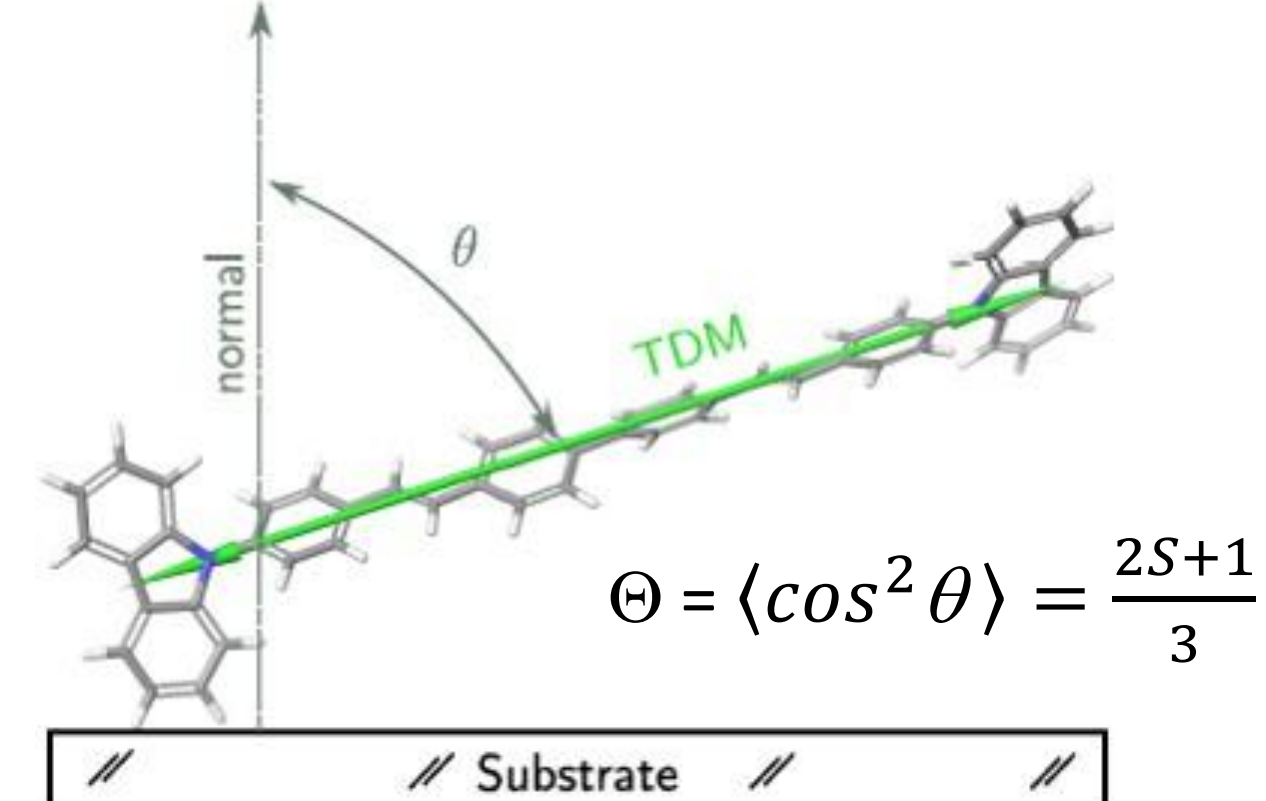
- Electrical field comparable to device in operation, called Giant Surface Potential (GSP)
- Controllable by dipolar doping, substrate temperature and evaporation rate
- Orientation of PDM can correlate with the TDM



### Film preparation and in-situ measurement by Kelvin-Probe (KP)

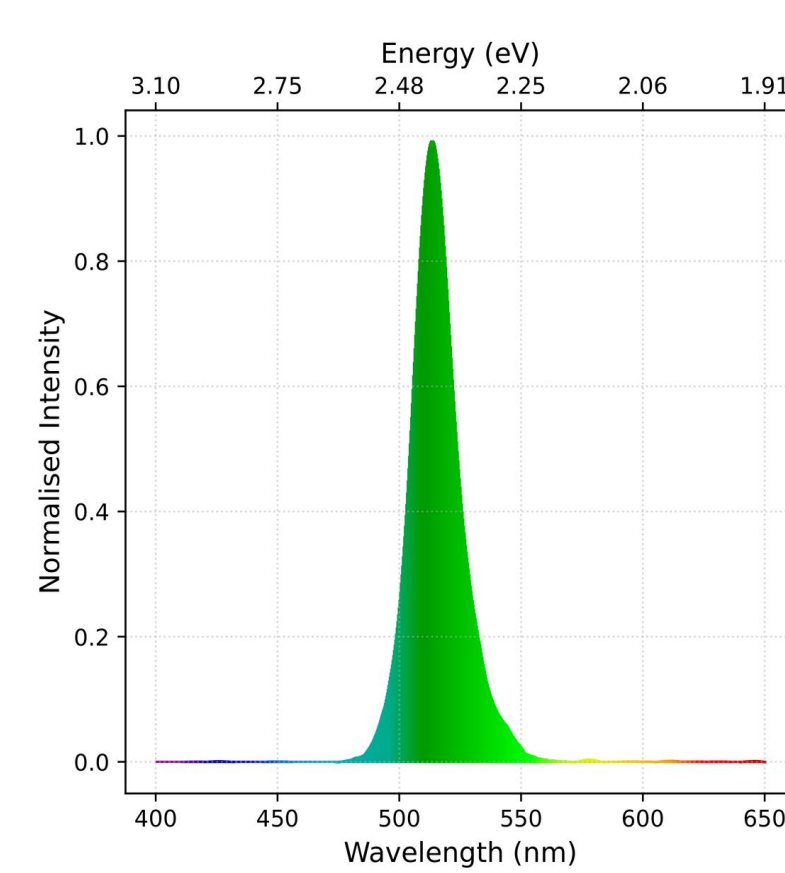
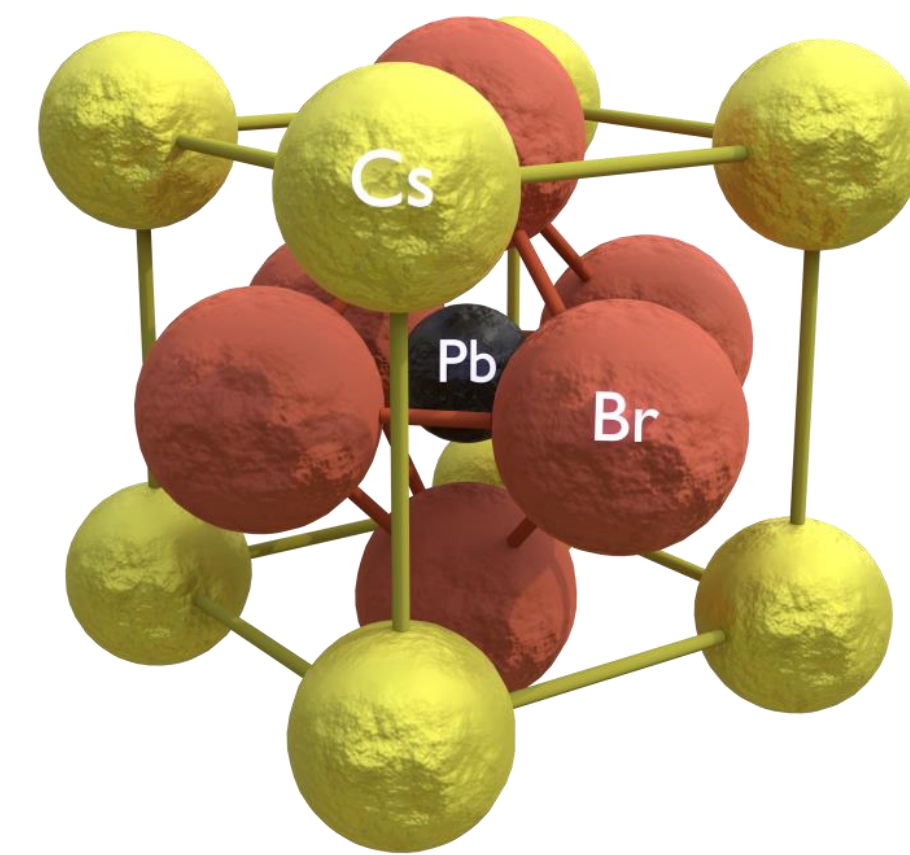


### Orientation of the optical Transition Dipole Moment (TDM)



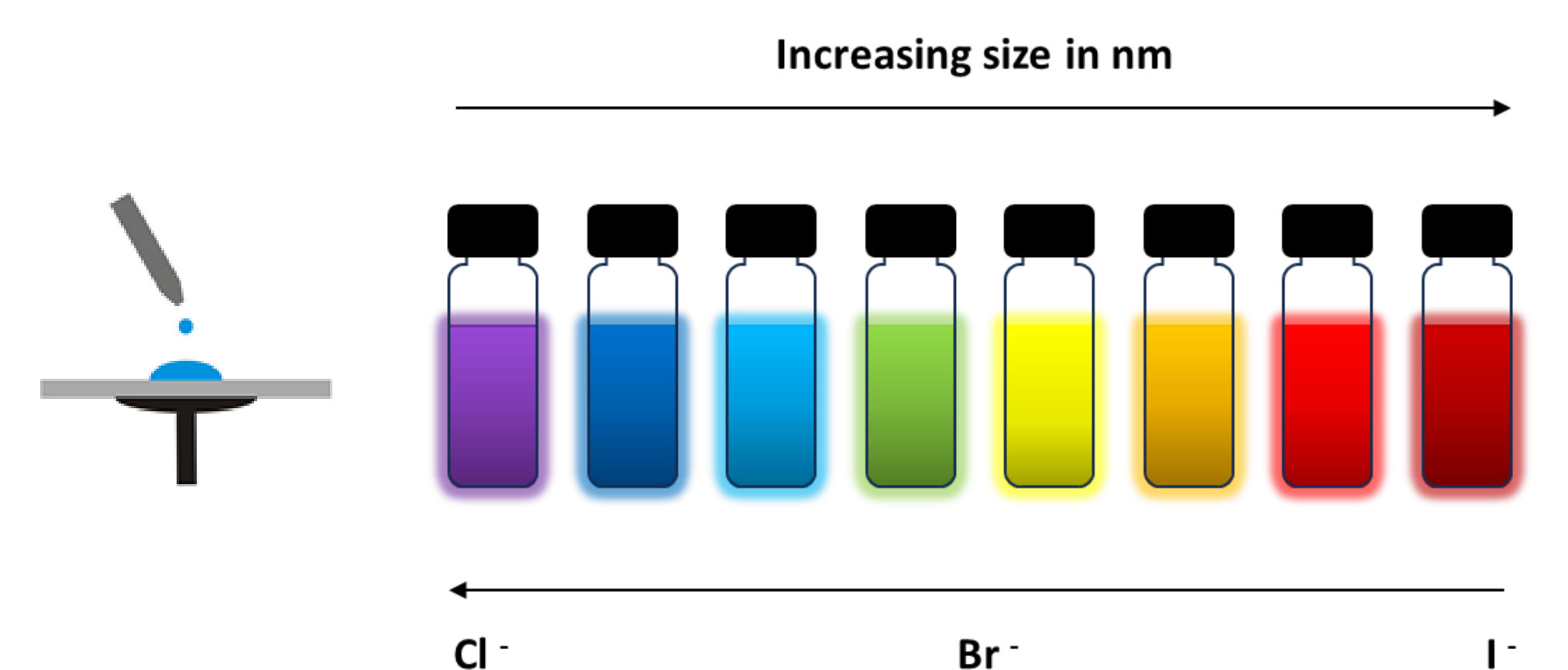
Molecules show horizontal orientation (TDM)  
→ More Light Outcoupling  
→ Higher Efficiency

## Lead halide perovskite nanocrystals for LEDs



Quantum dot perovskite nanocrystals with ABX<sub>3</sub> crystal structure are excellent candidates for light emitting applications due to their:

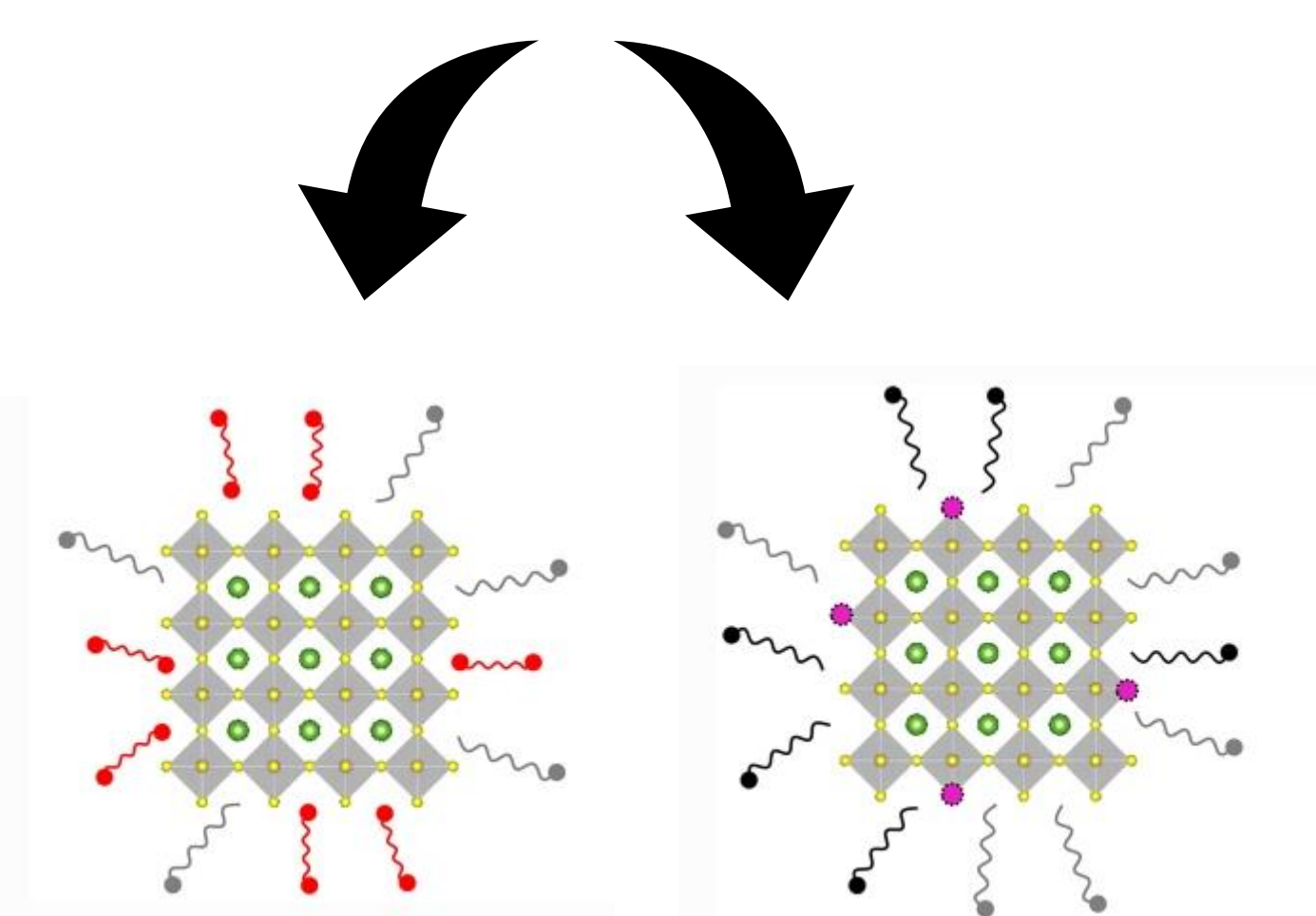
- High defect tolerance and quantum efficiency
- Tunable bandgap by size or composition
- Narrow FWHM of emission spectra
- Solution processable



Where's the catch? → Stability & charge injection

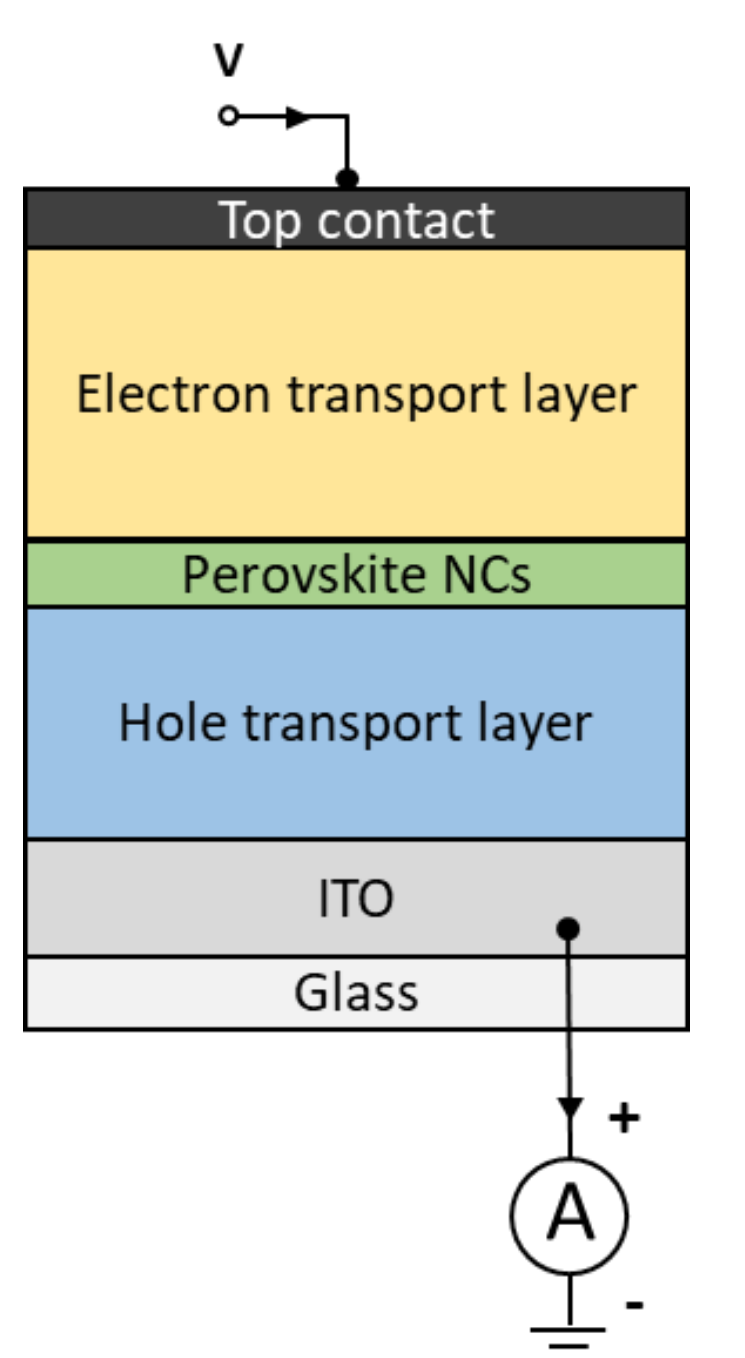
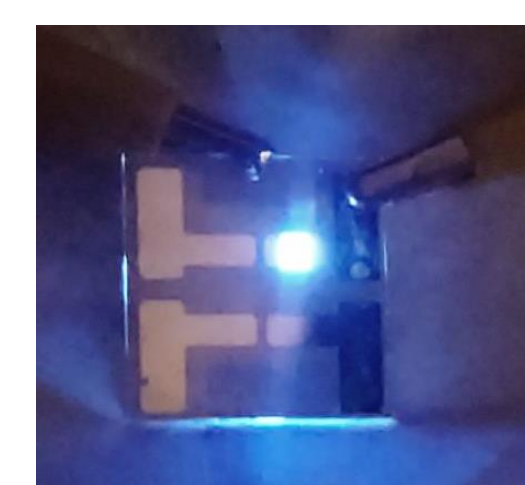
How do we solve this?

Goal: Highly efficient LEDs



Ligand Engineering

Doping



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SCAN ME

