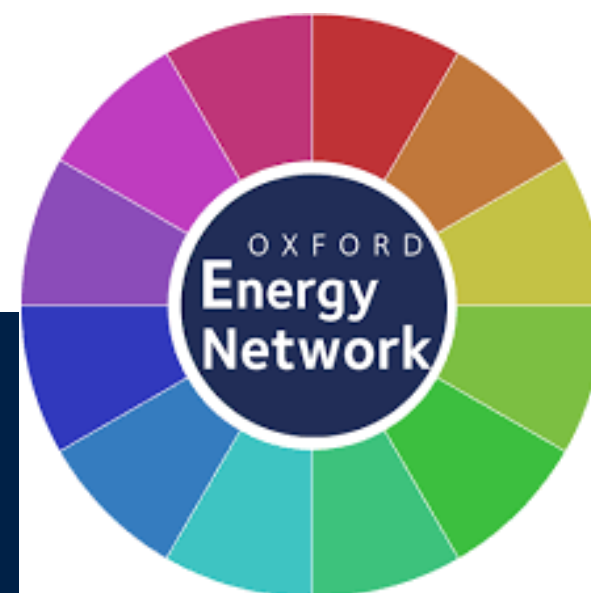


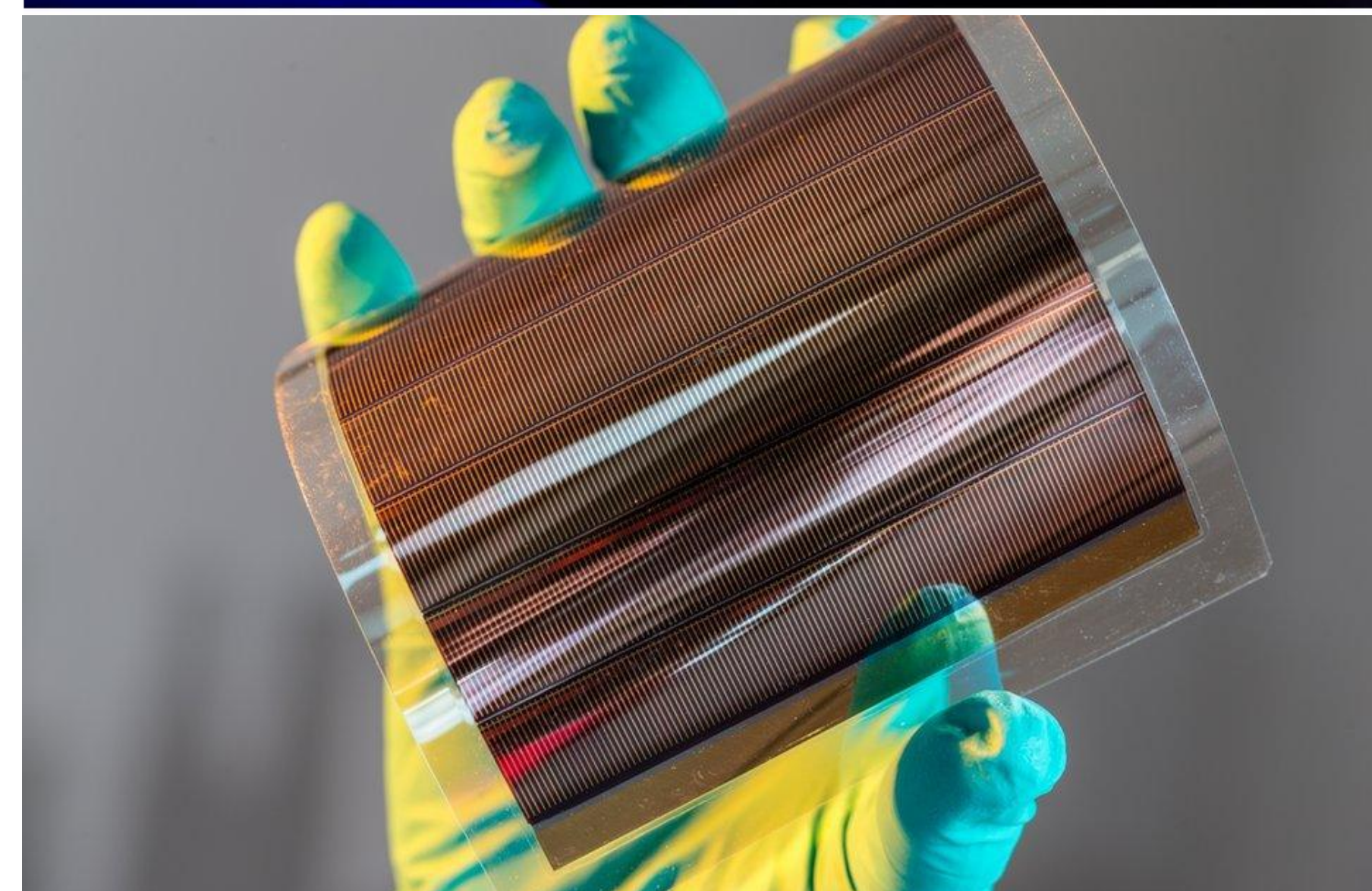


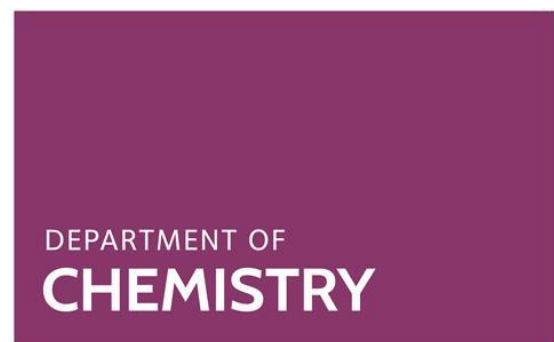
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Key Challenges Facing Organic Semiconductors for Electricity-Light Interconversion

Dr Dan Congrave





Synthesis of Organic Electronic Materials at Oxford



Prof. Iain McCulloch FRS



Prof. Harry Anderson FRS



Prof. Matt Fuchter



Prof. Paul McGonical



Dr. Alyssa-Jennifer
Avestro



Dr. Dan Congrave

Organic Semiconductors

1) High value electronic materials from ideally plentiful and renewable carbon-based feedstocks

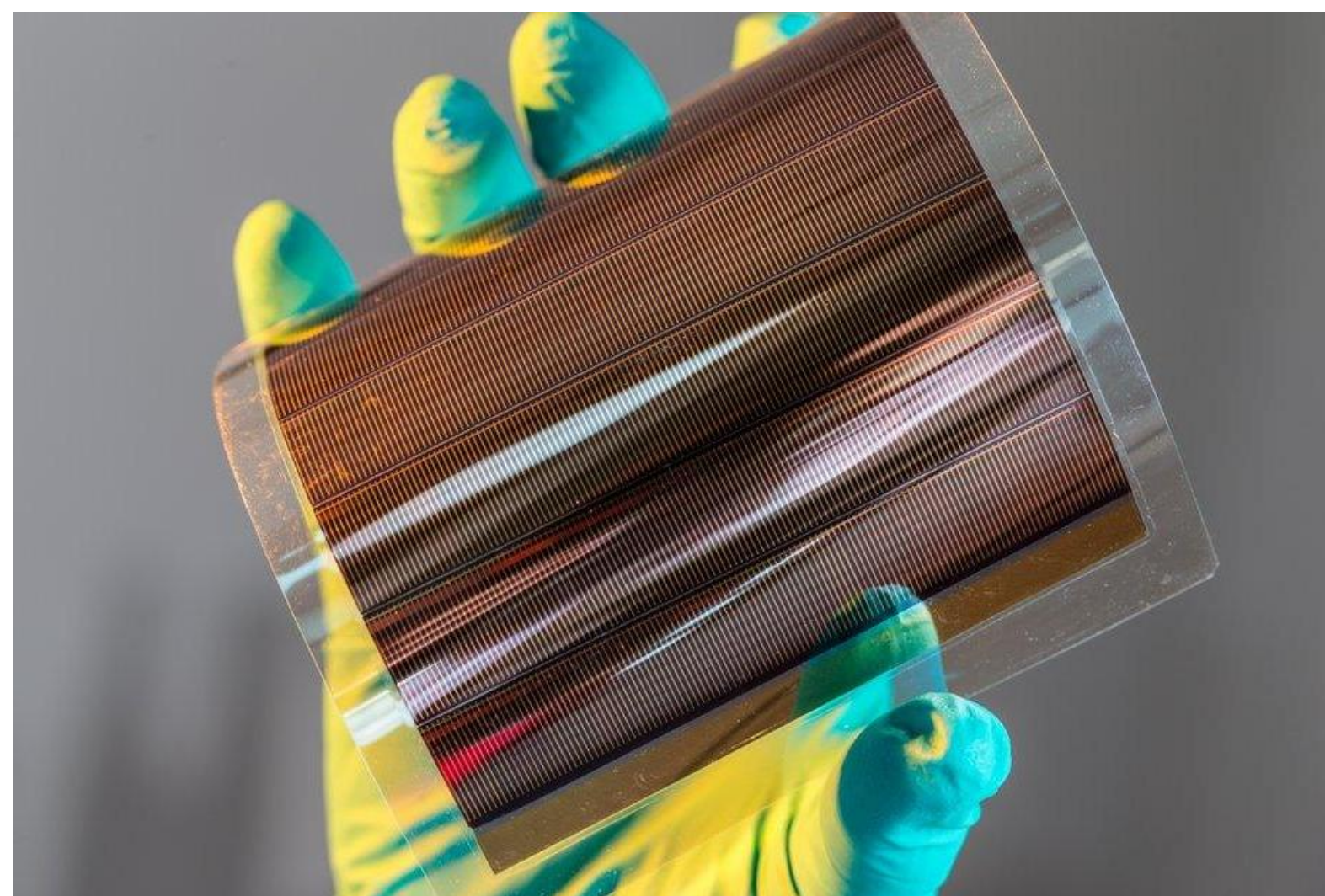


Organic Semiconductors

1) High value electronic materials from ideally plentiful and renewable carbon-based feedstocks



2) Diverse and unique processability

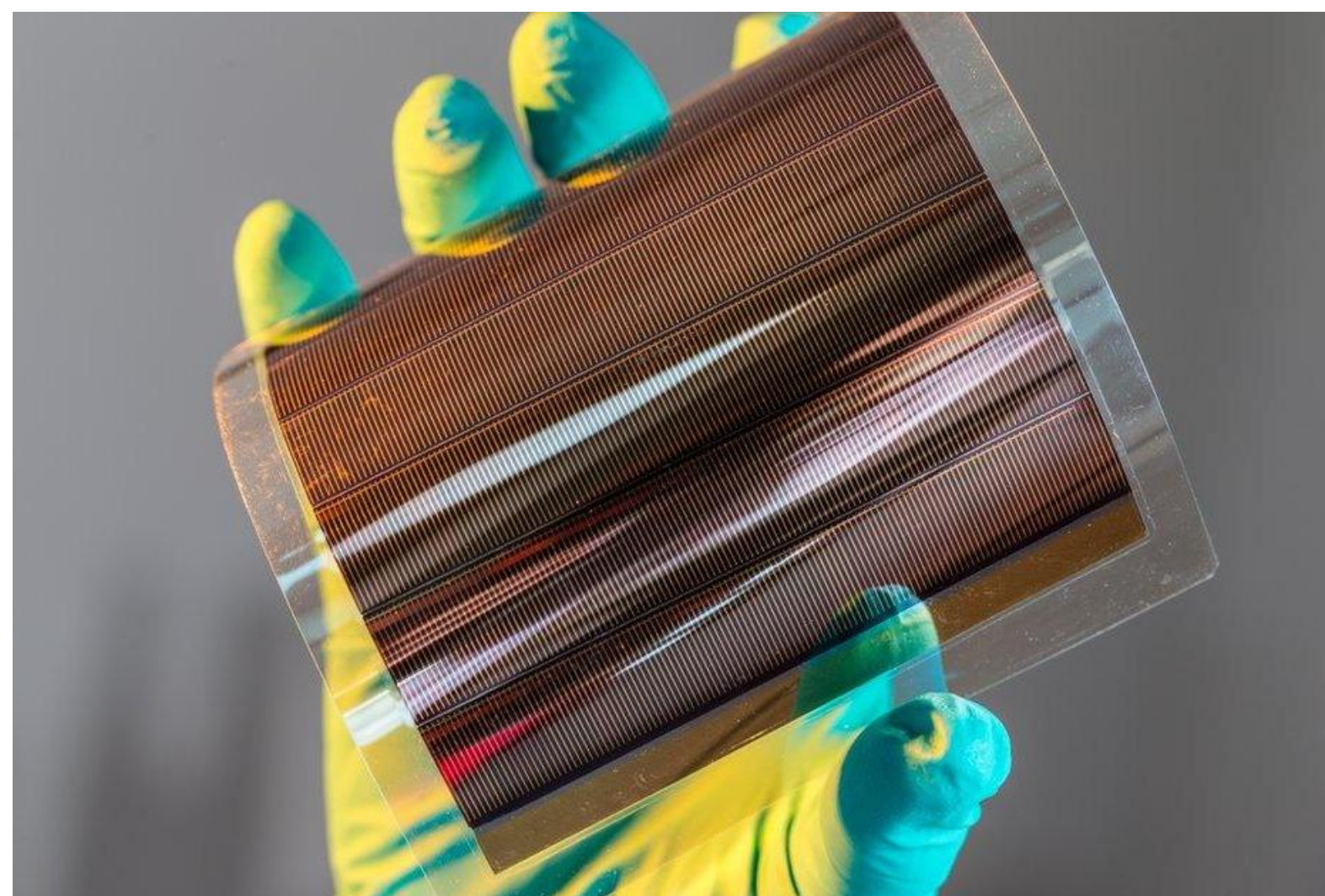


Organic Semiconductors

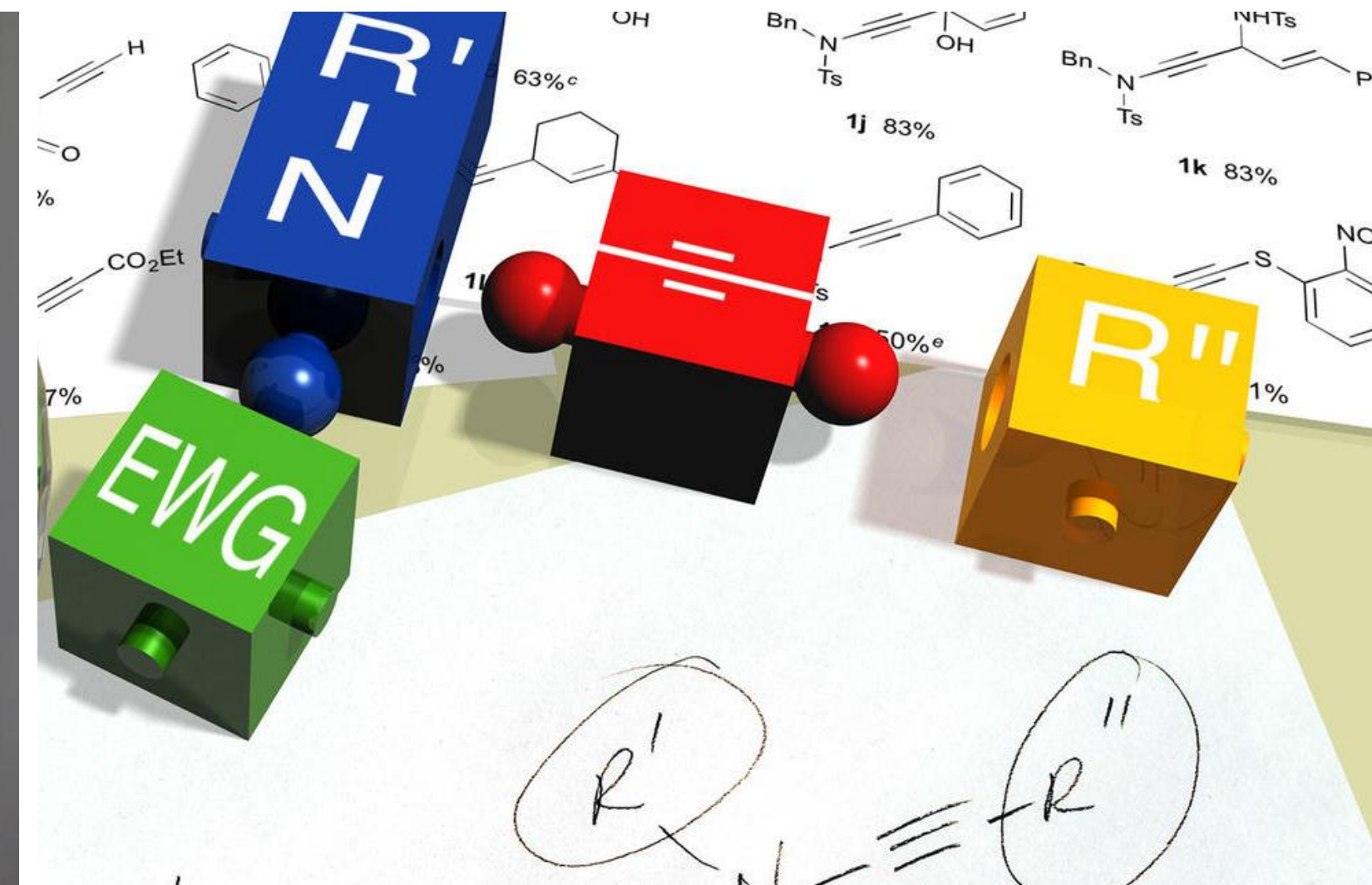
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2) Diverse and unique processability



3) Exploit the unique power of synthetic organic chemistry

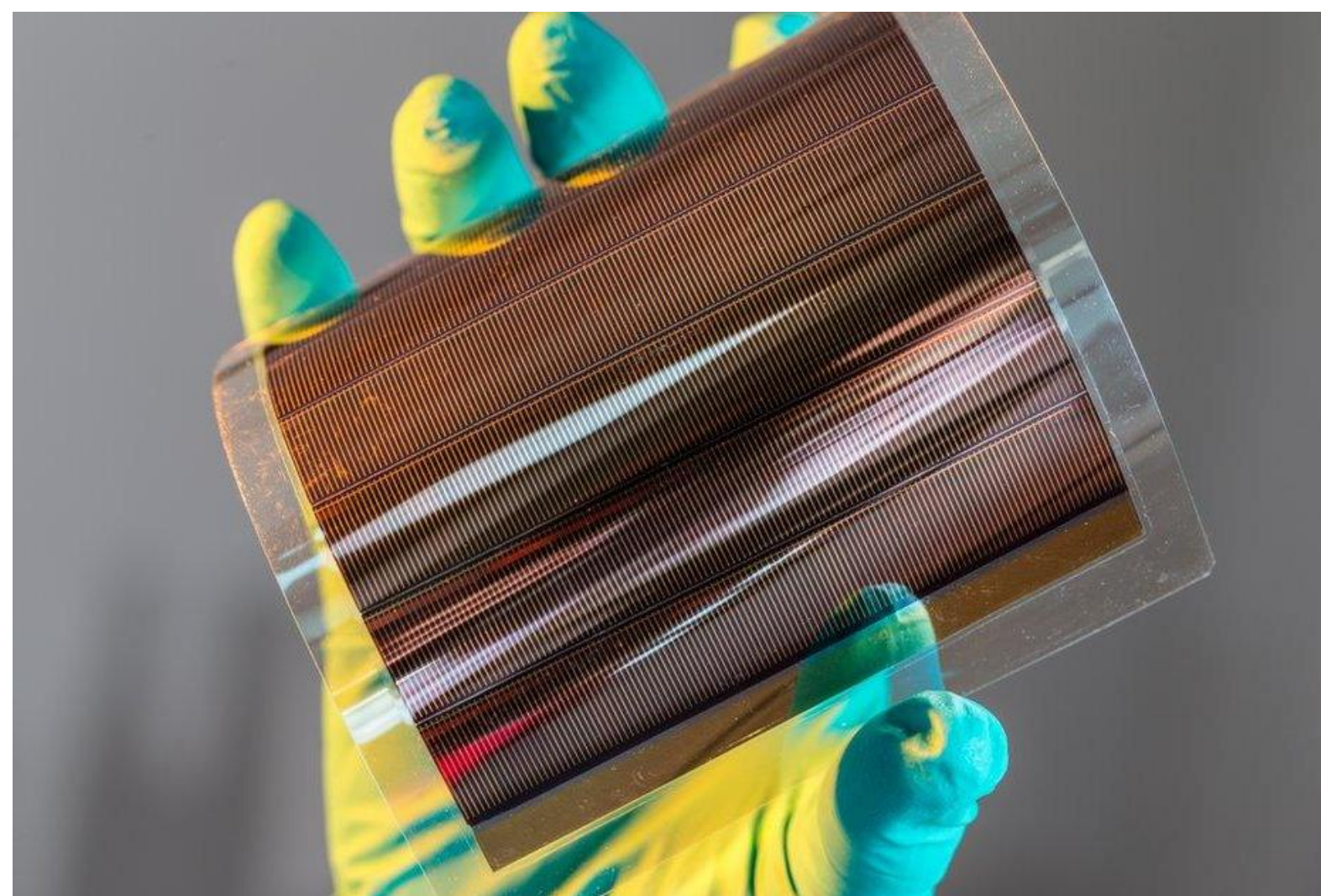


Organic Semiconductors

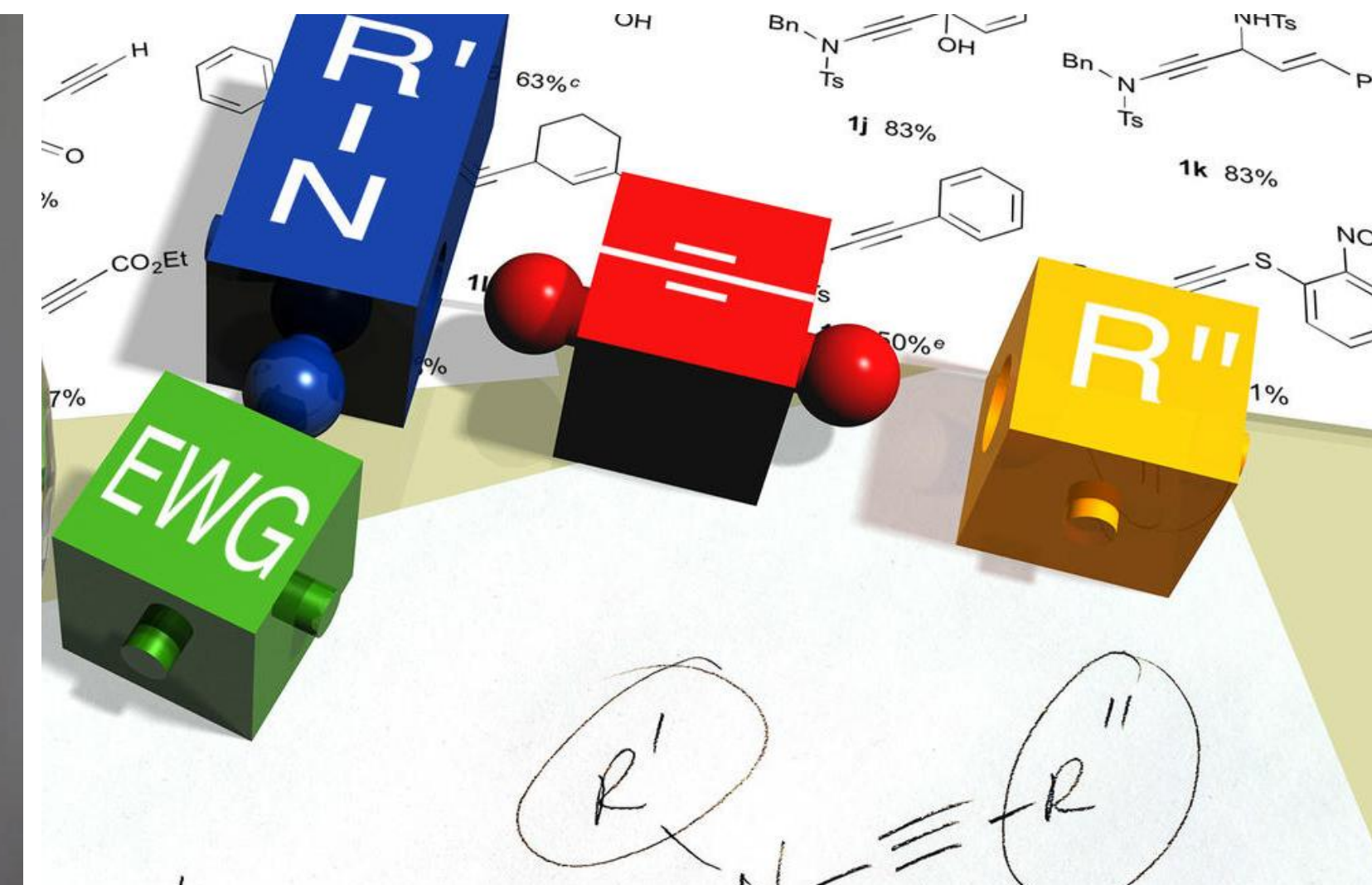
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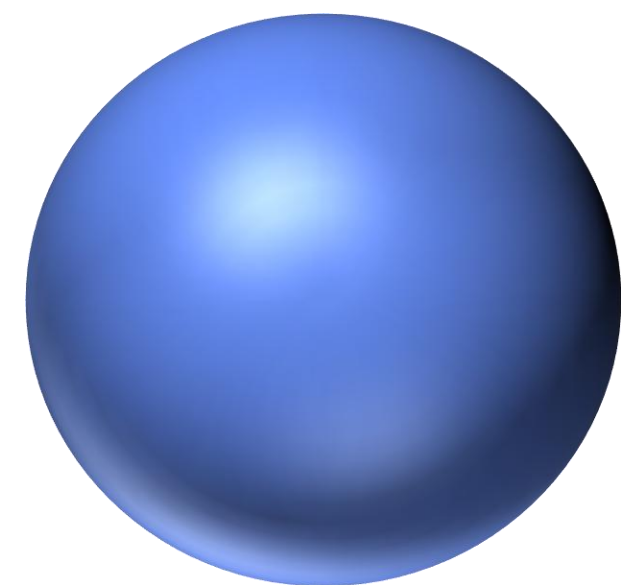
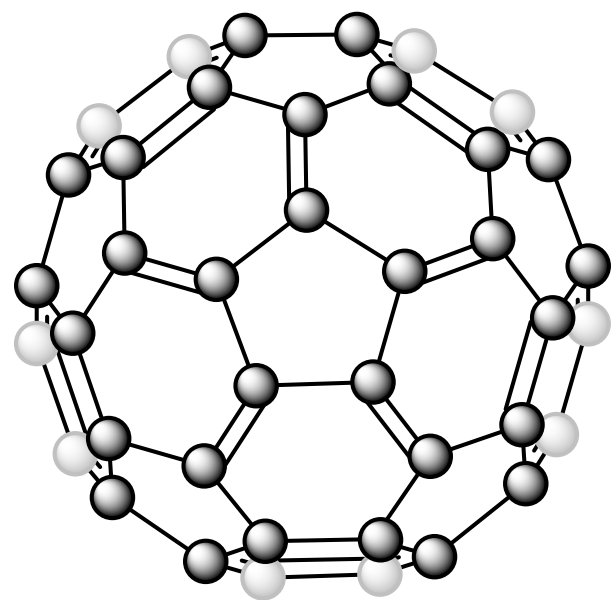


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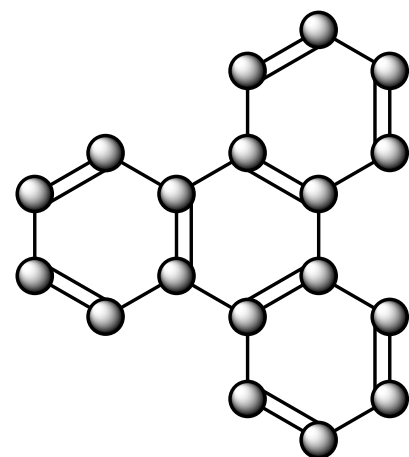
Organic Semiconductors

3D



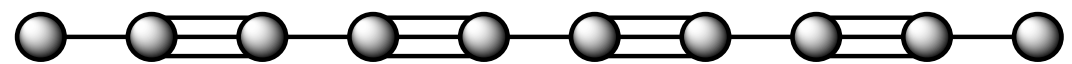
Balls

2D



Disks

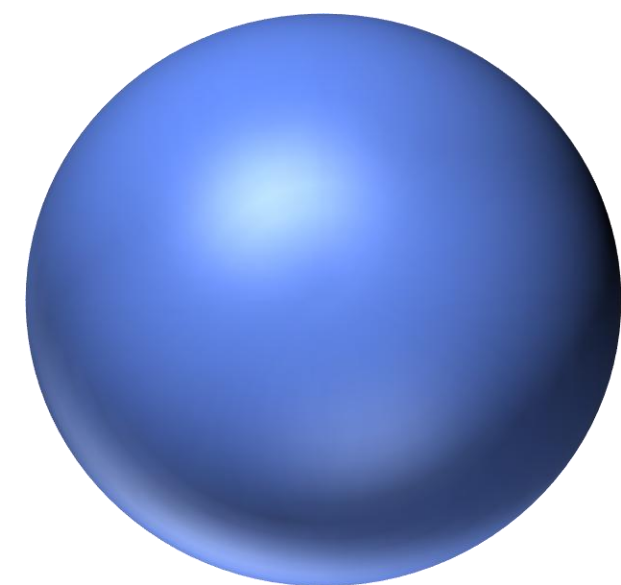
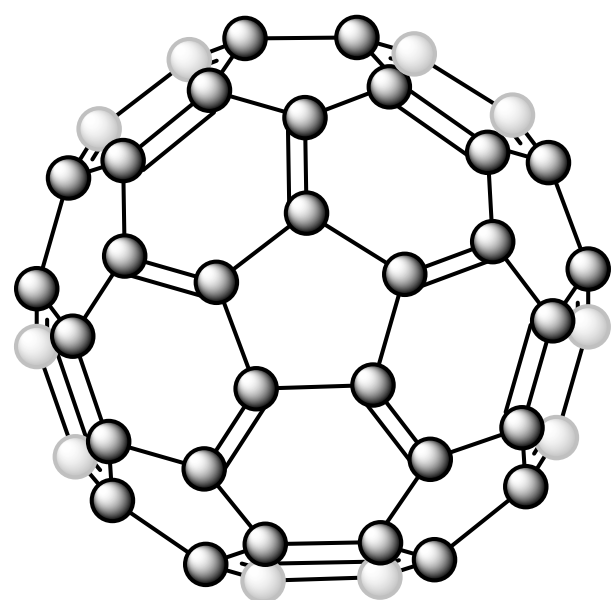
1D



Rods

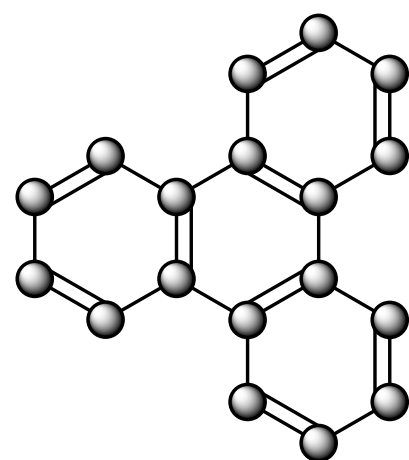
Organic Semiconductors

3D



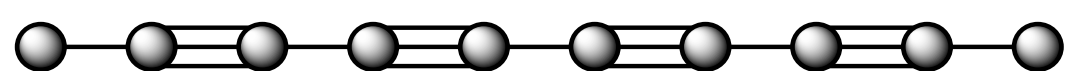
Balls

2D

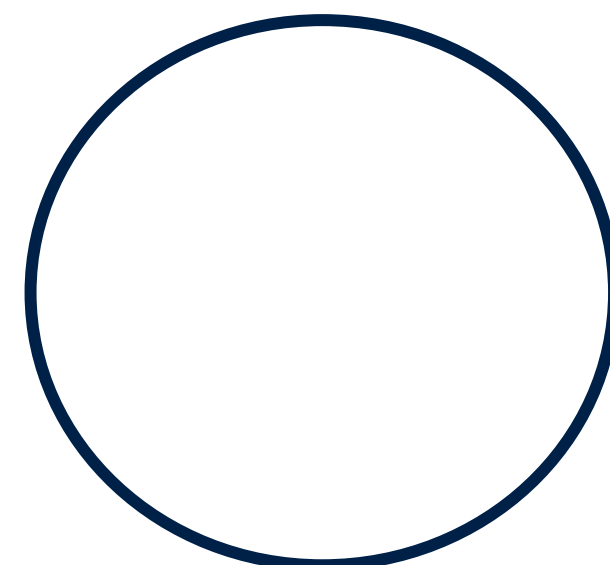
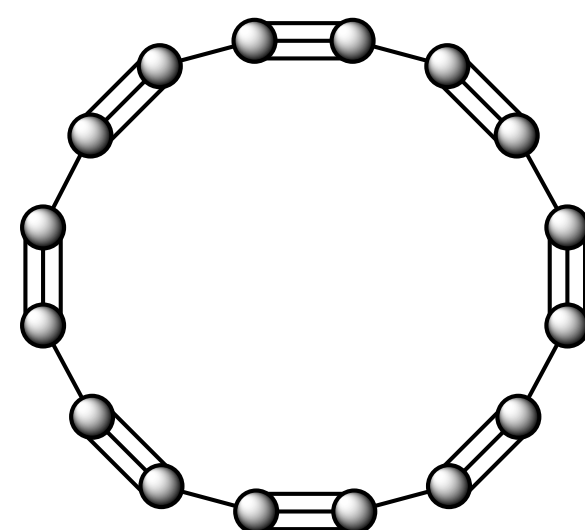


Disks

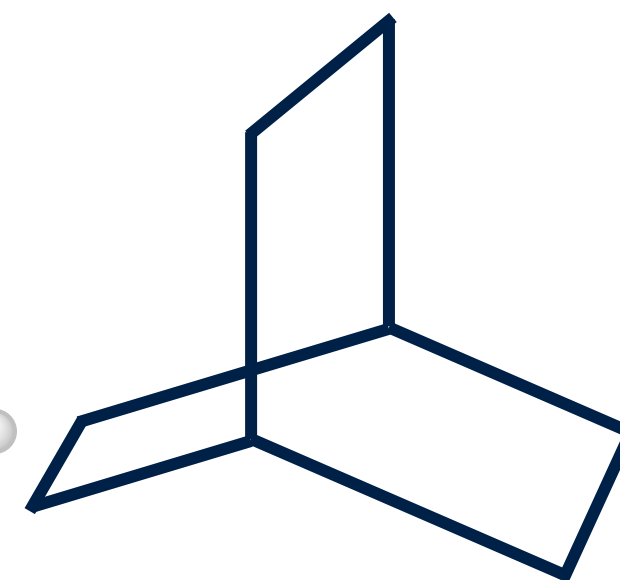
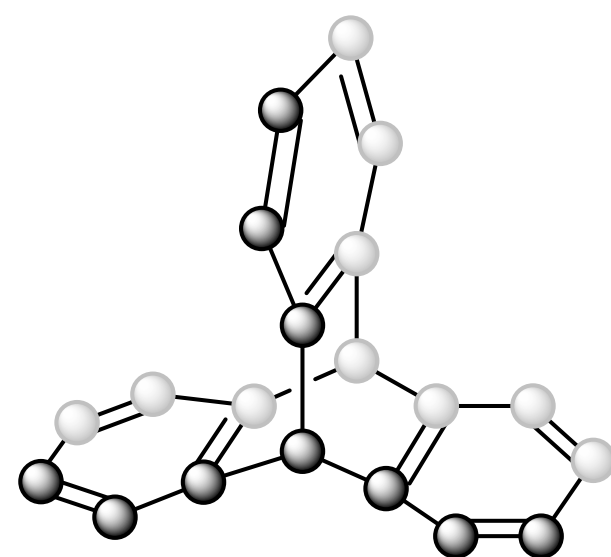
1D



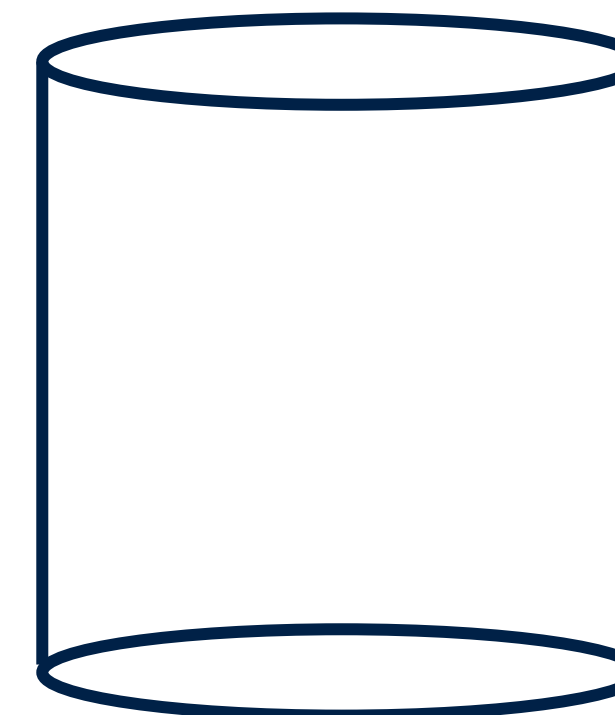
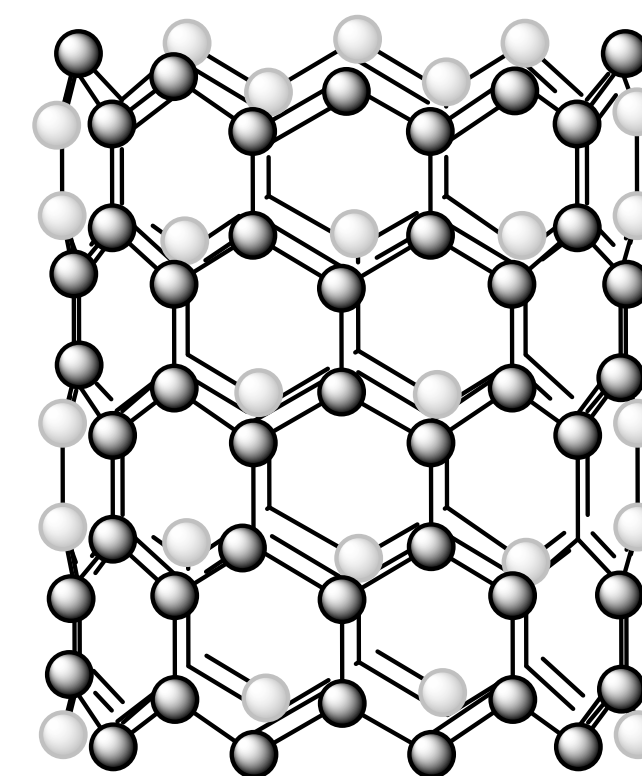
Rods



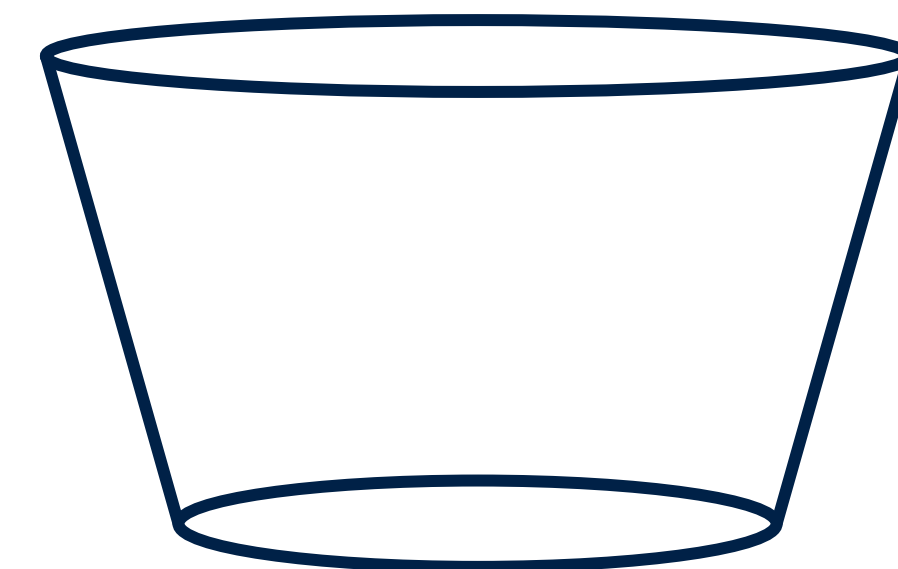
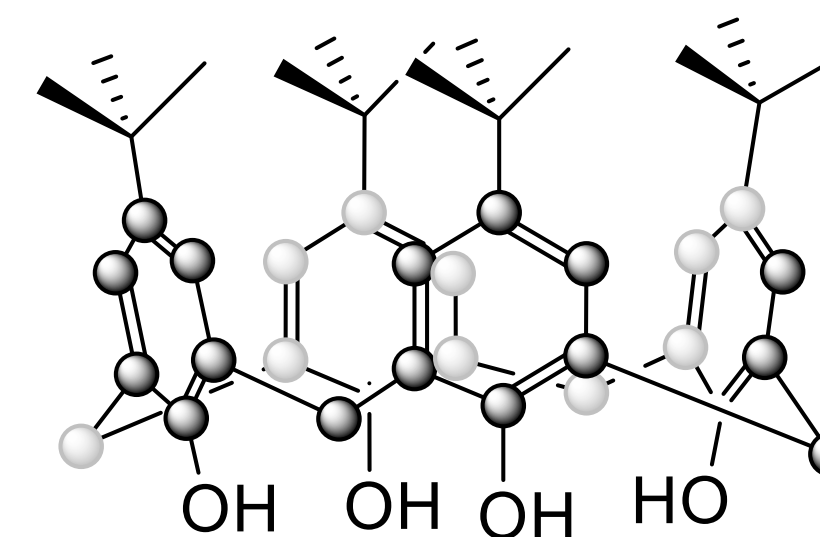
Rings



Propellers



Tubes



Cones

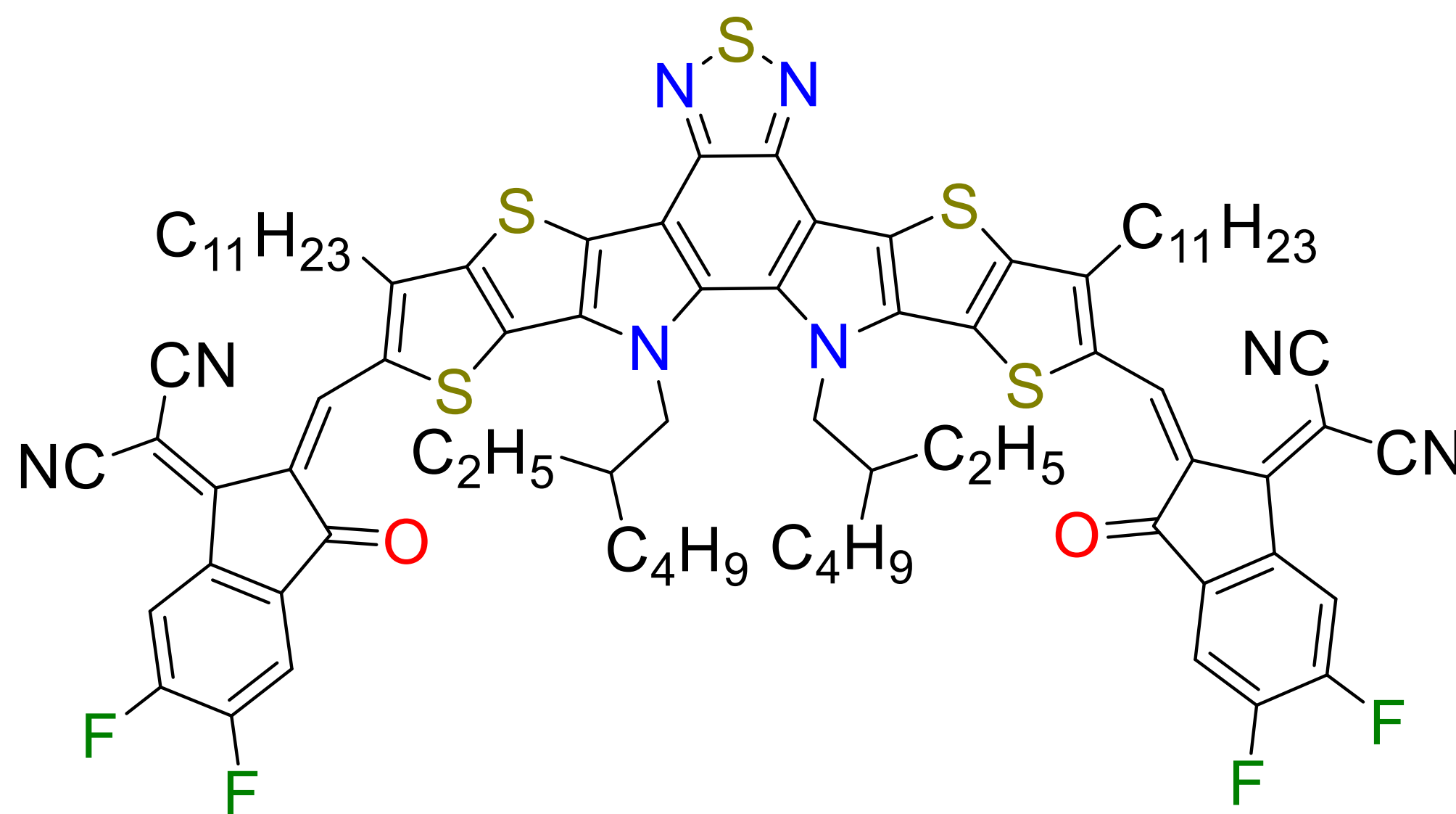


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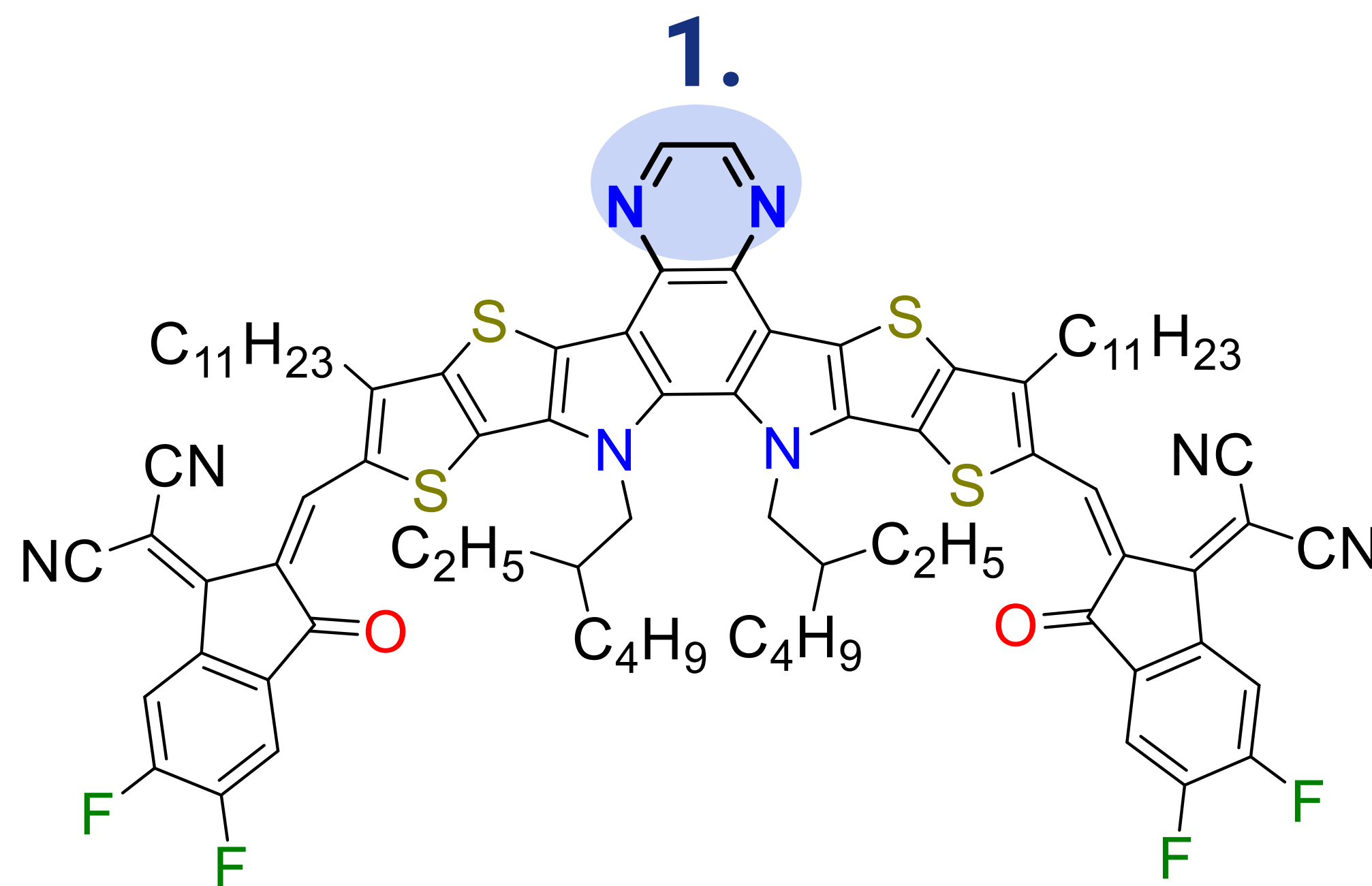
DEPARTMENT OF
CHEMISTRY



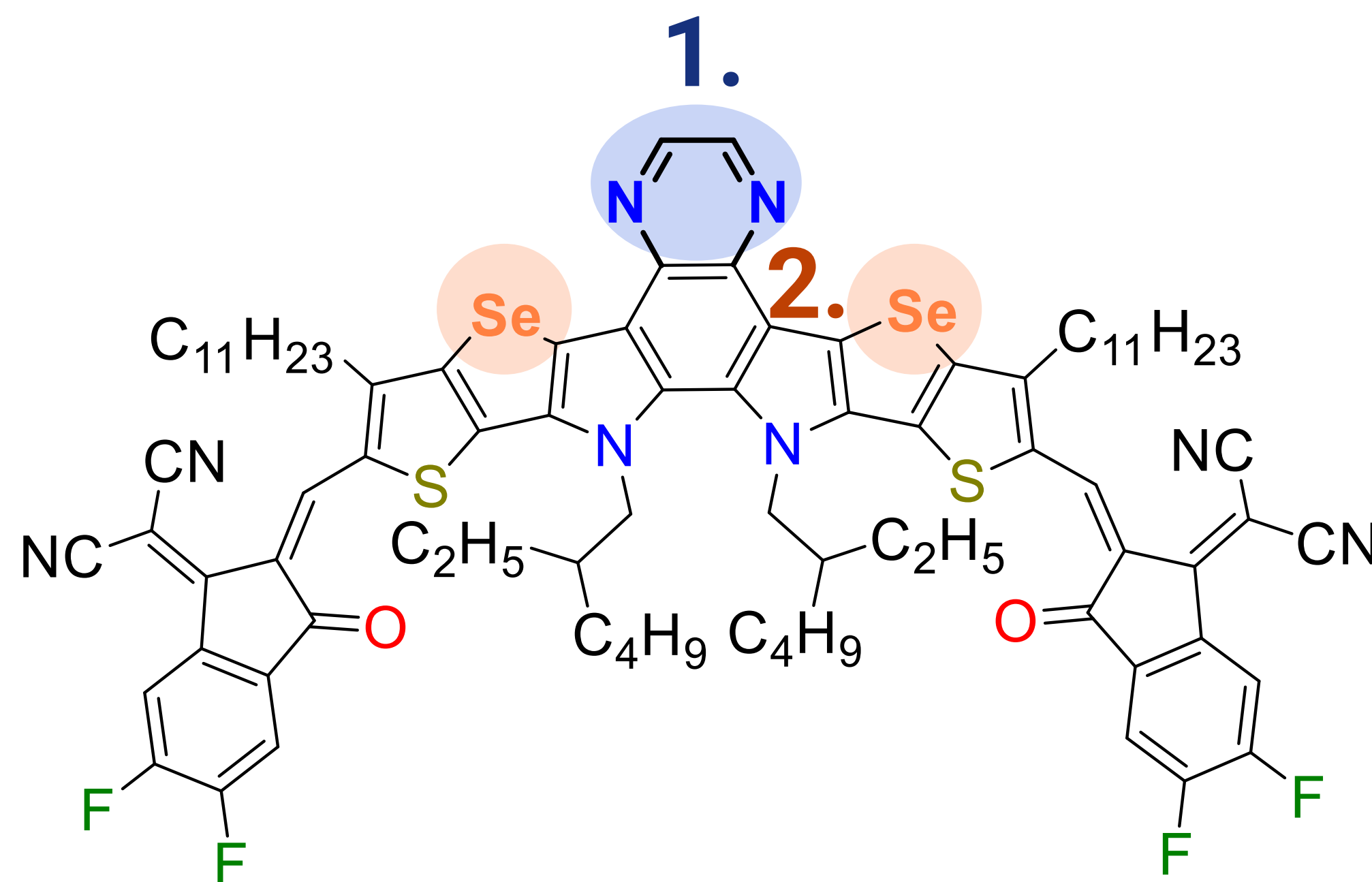
Organic Semiconductors



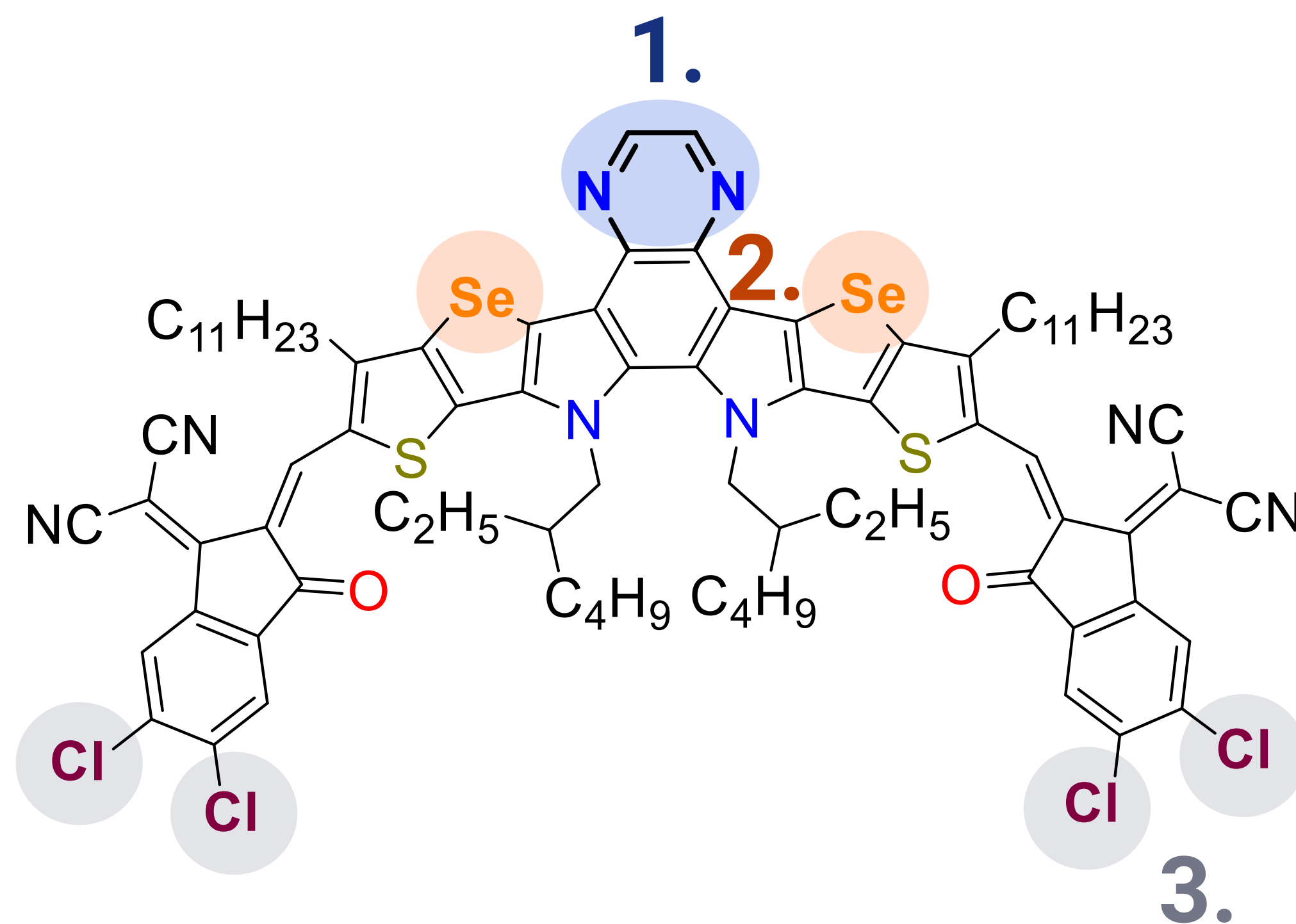
Organic Semiconductors



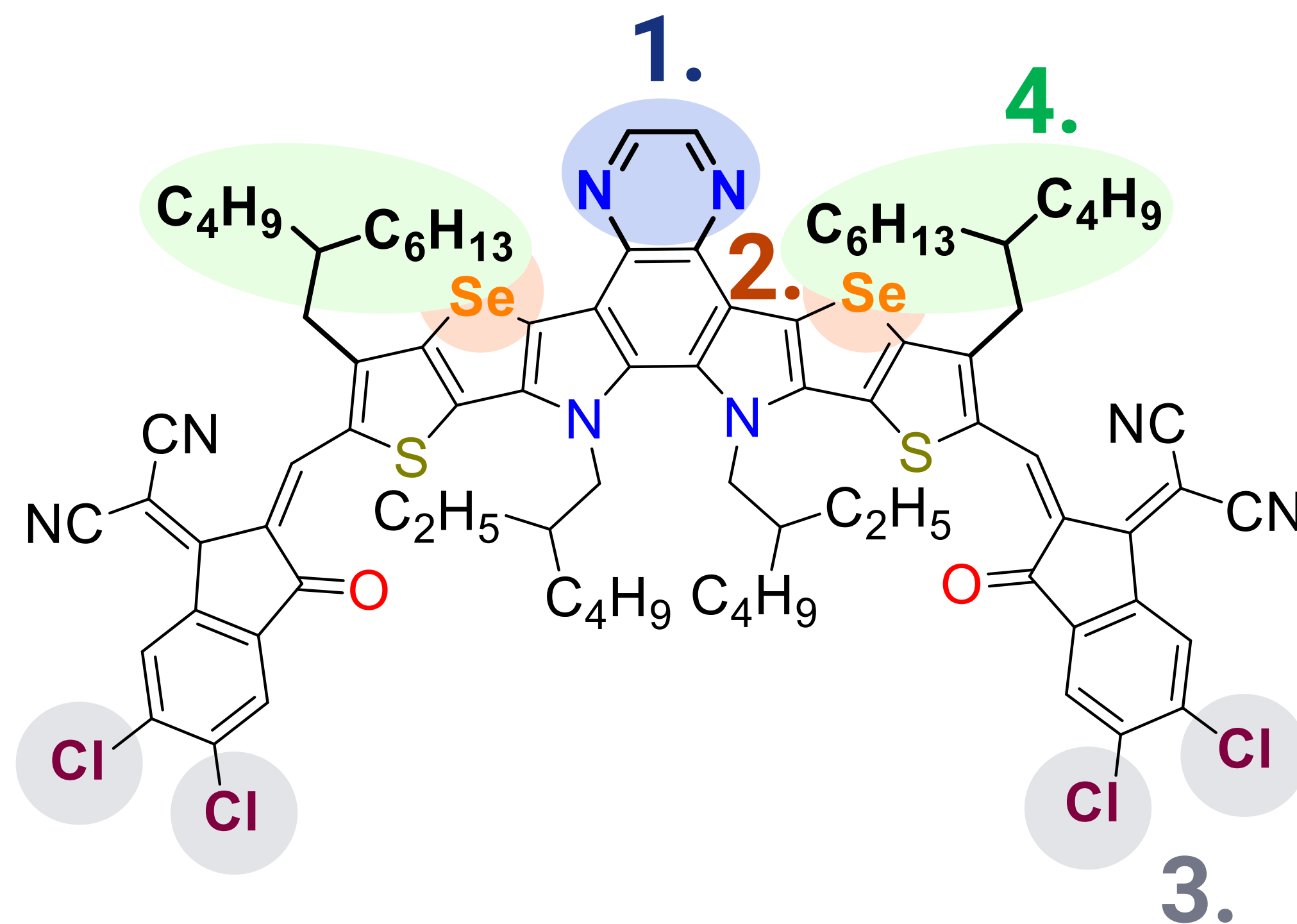
Organic Semiconductors



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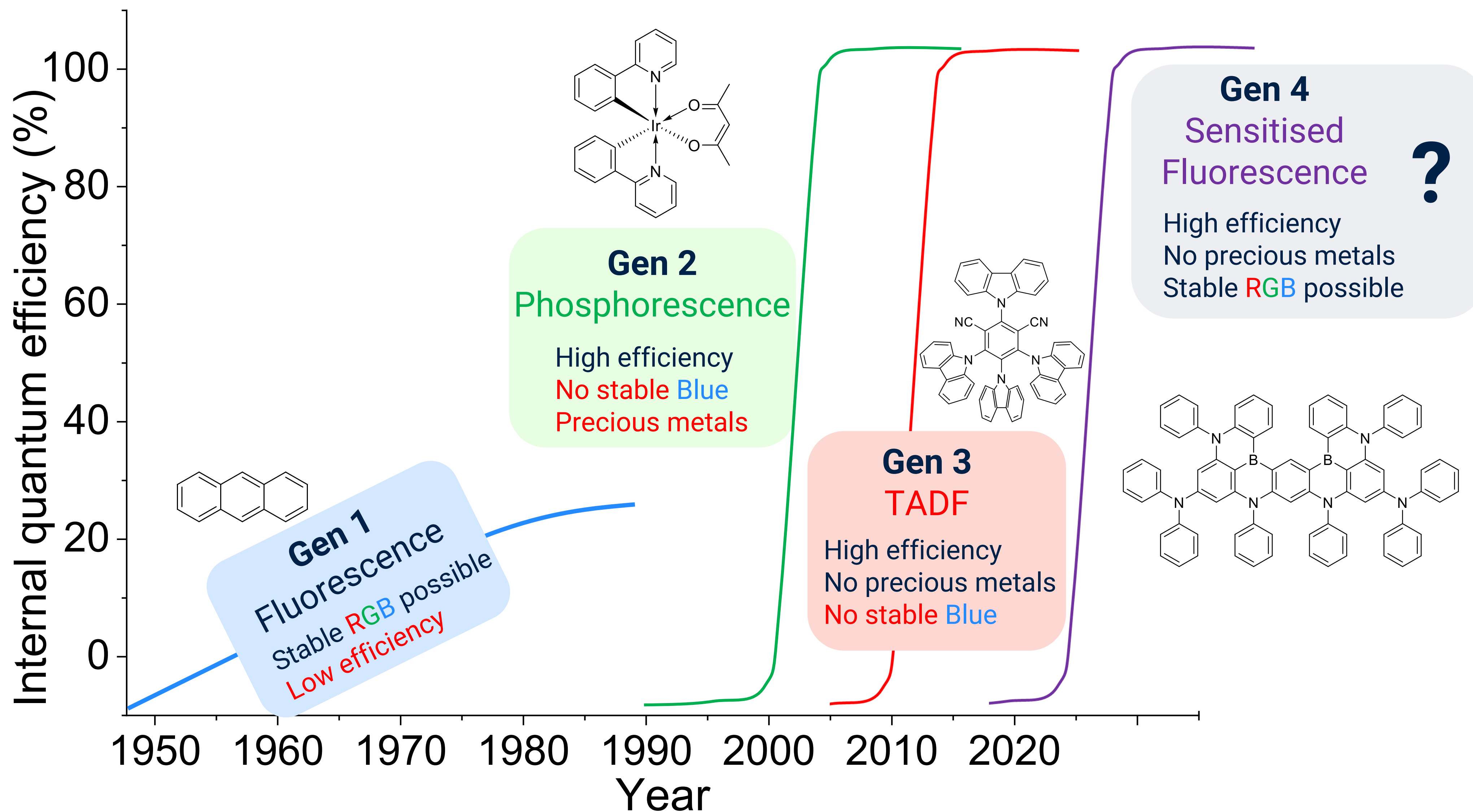
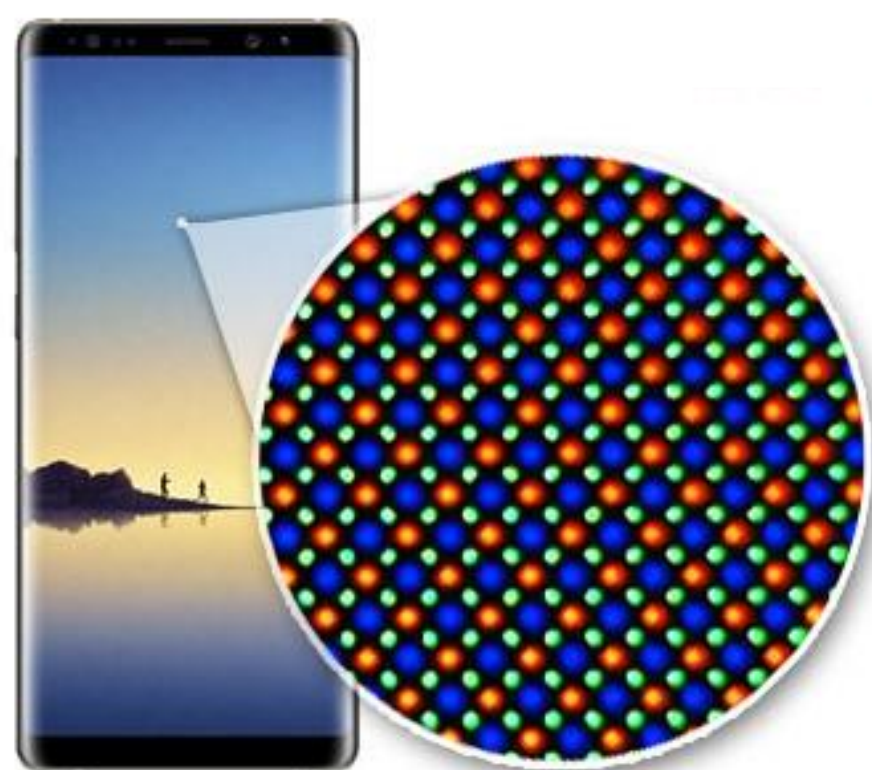


Organic Semiconductors



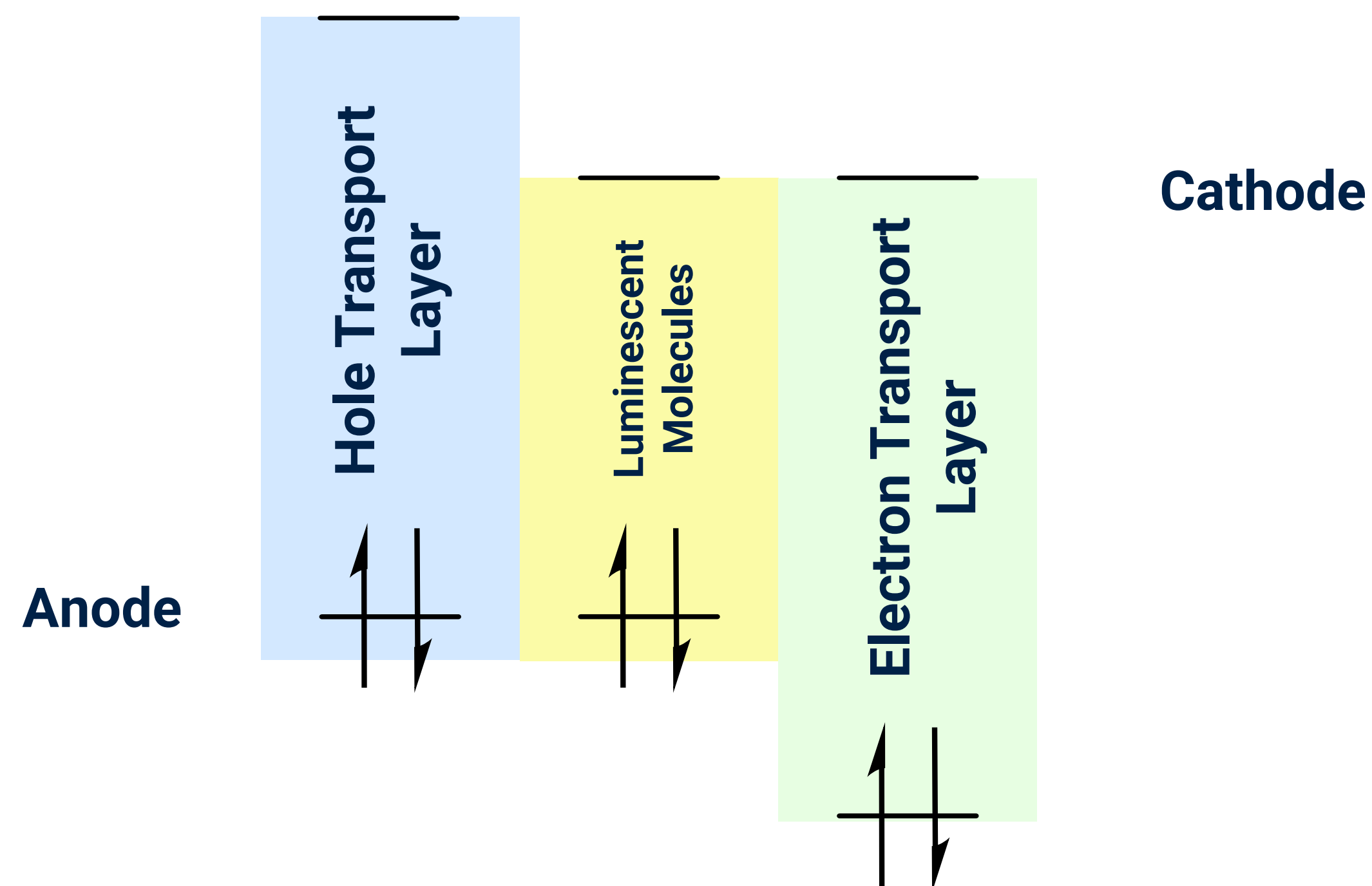
Organic Light Emitting Diodes (OLEDs)

OLEDs are now commercialised and make up >50% of all new smartphone displays



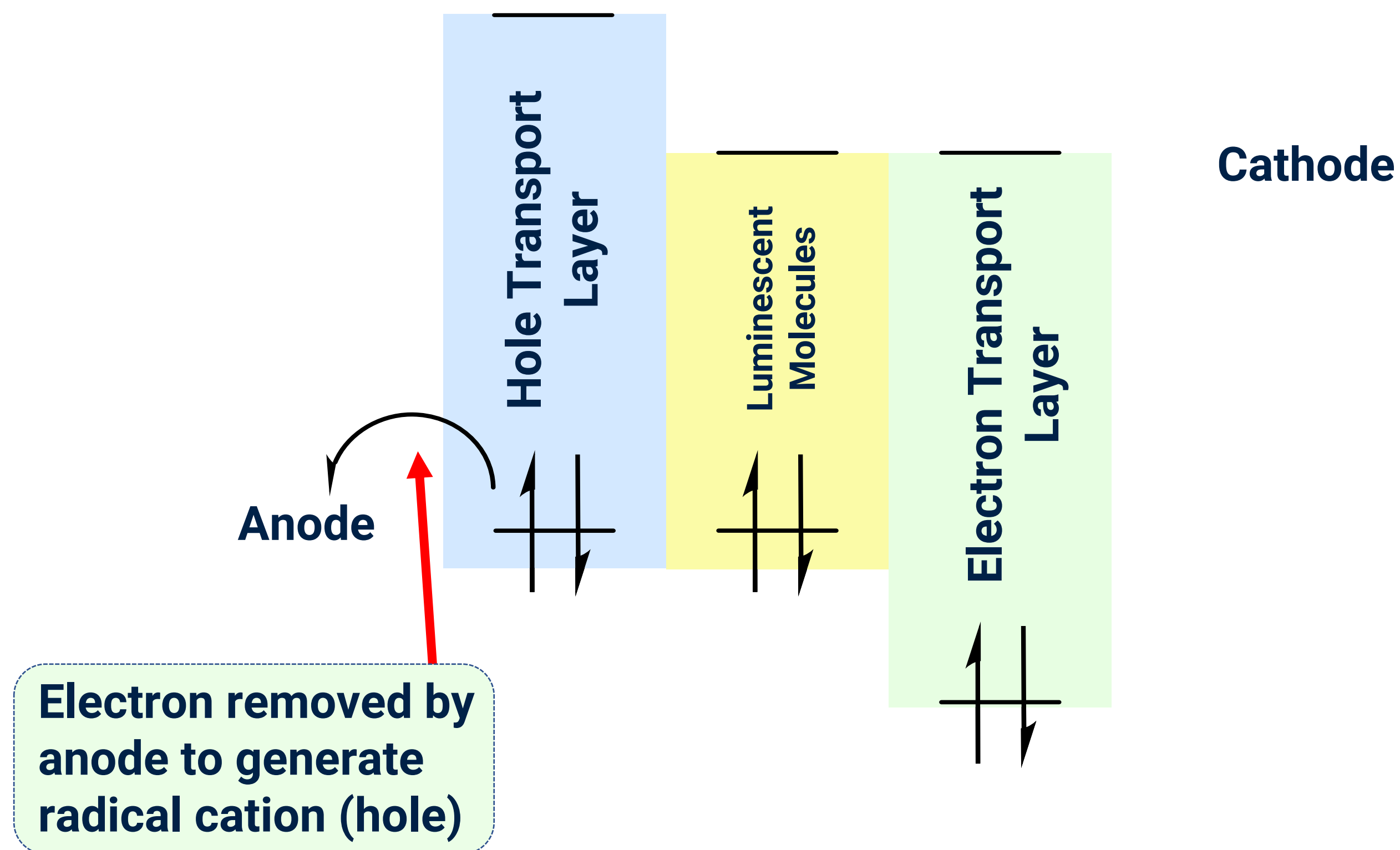
Organic Light Emitting Diodes (OLEDs)

What problem have we been trying to solve?



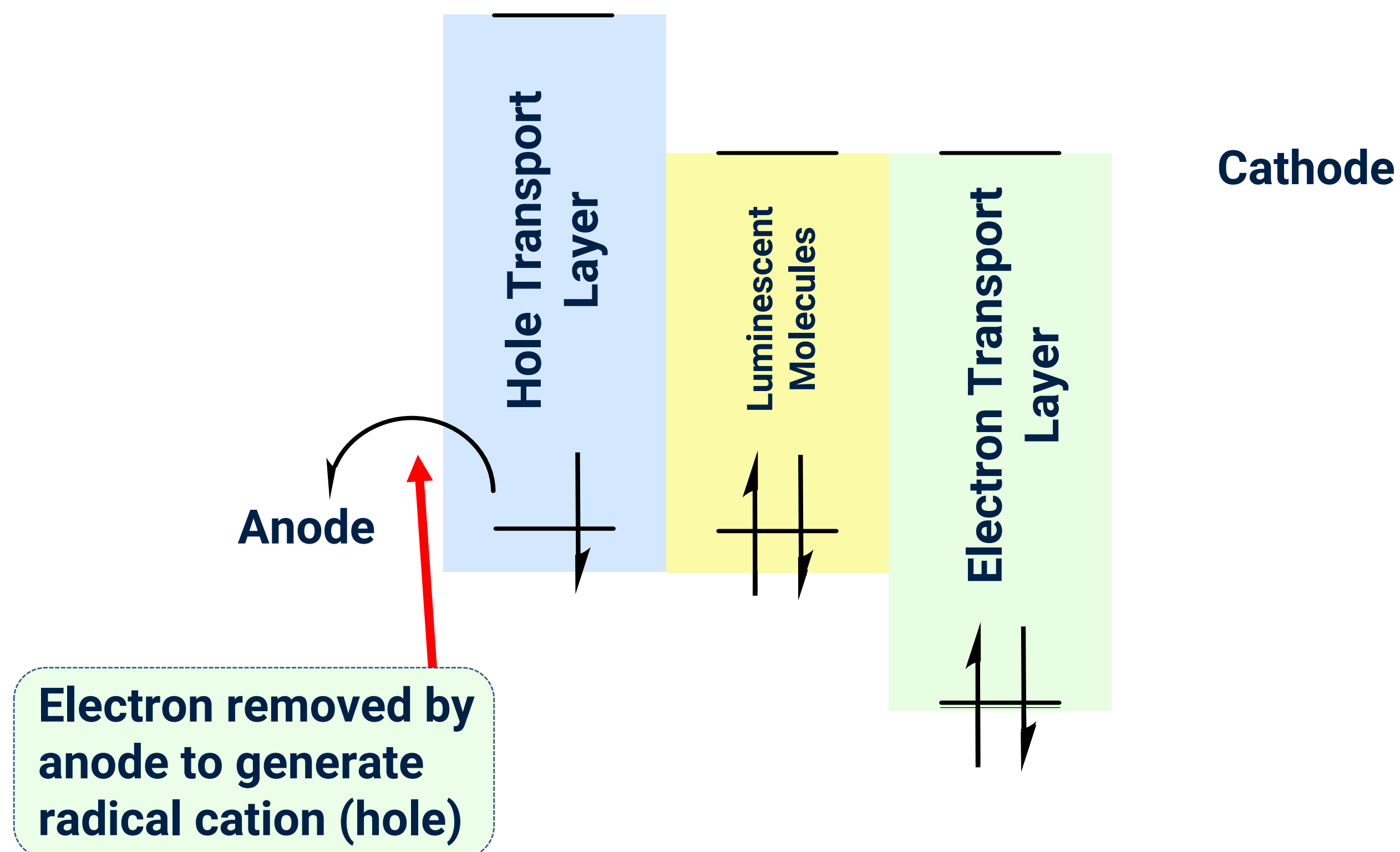
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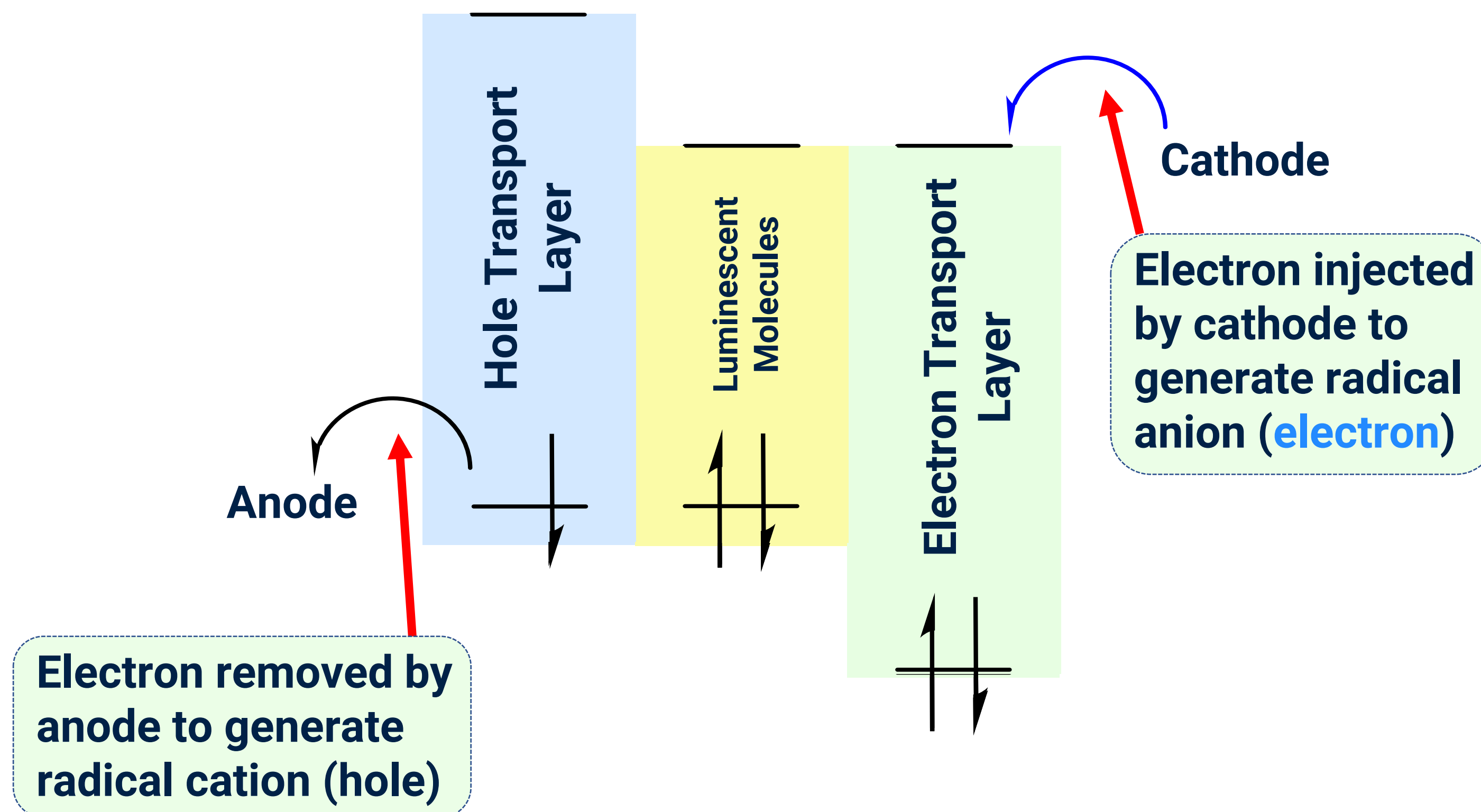
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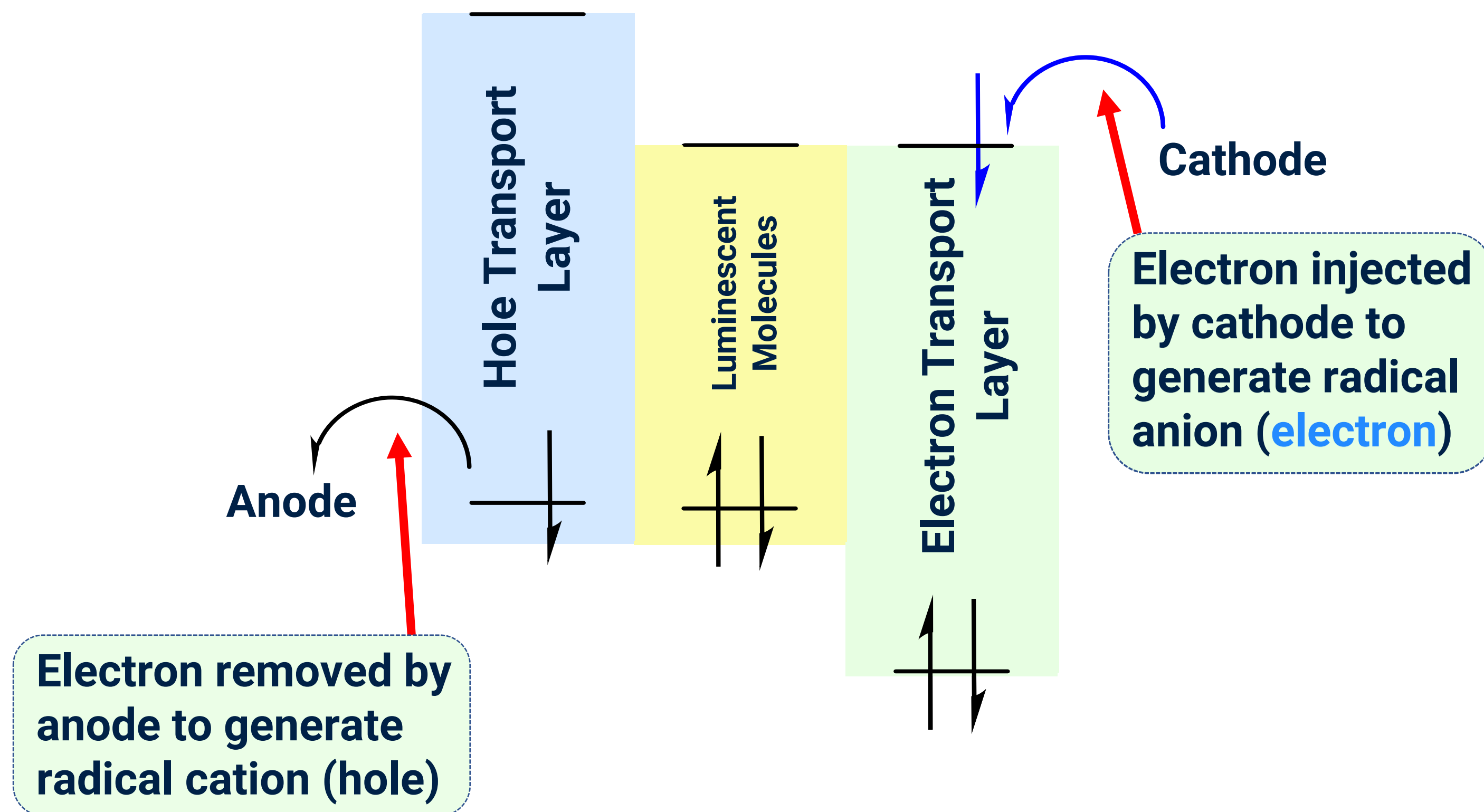
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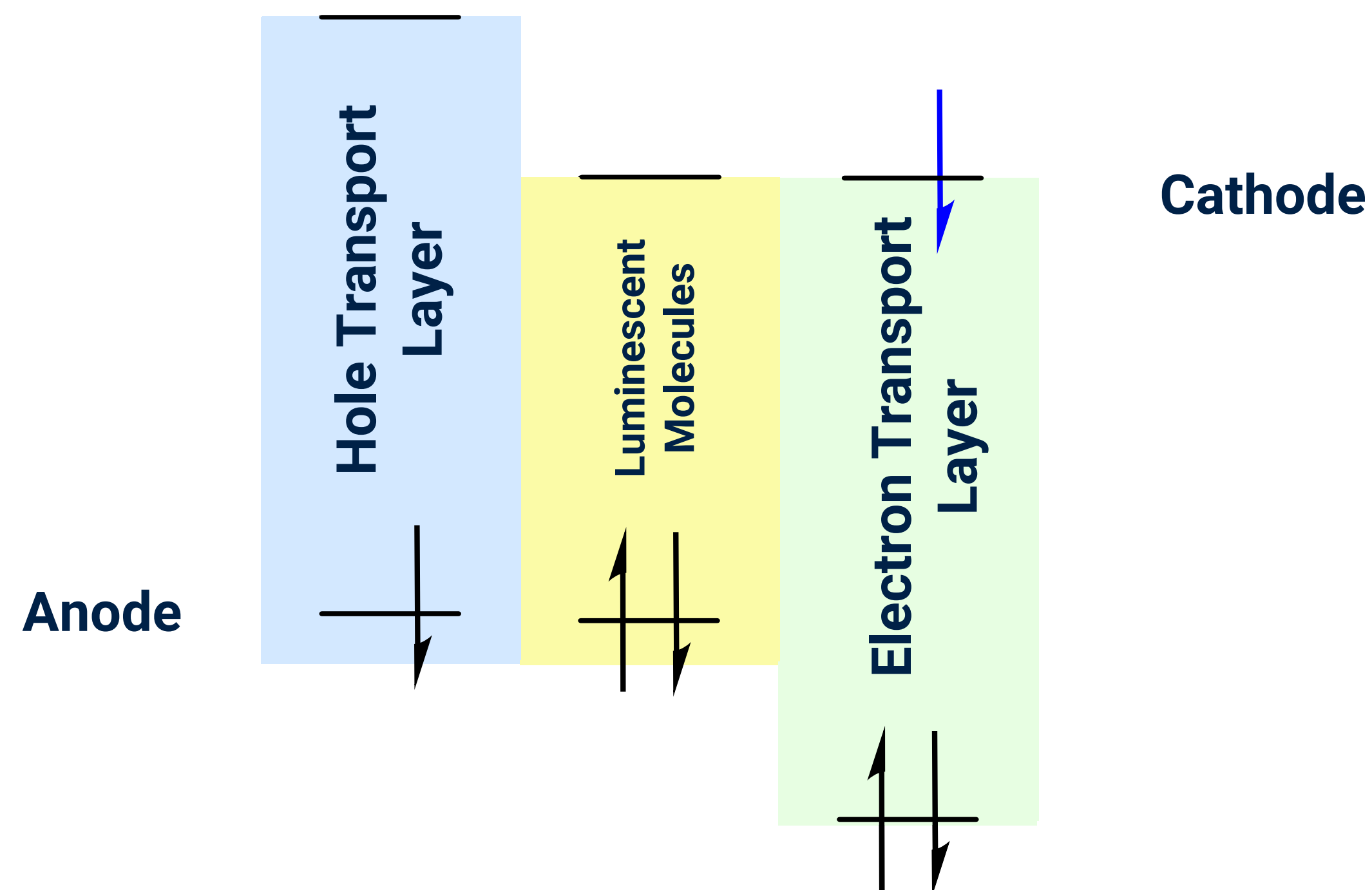
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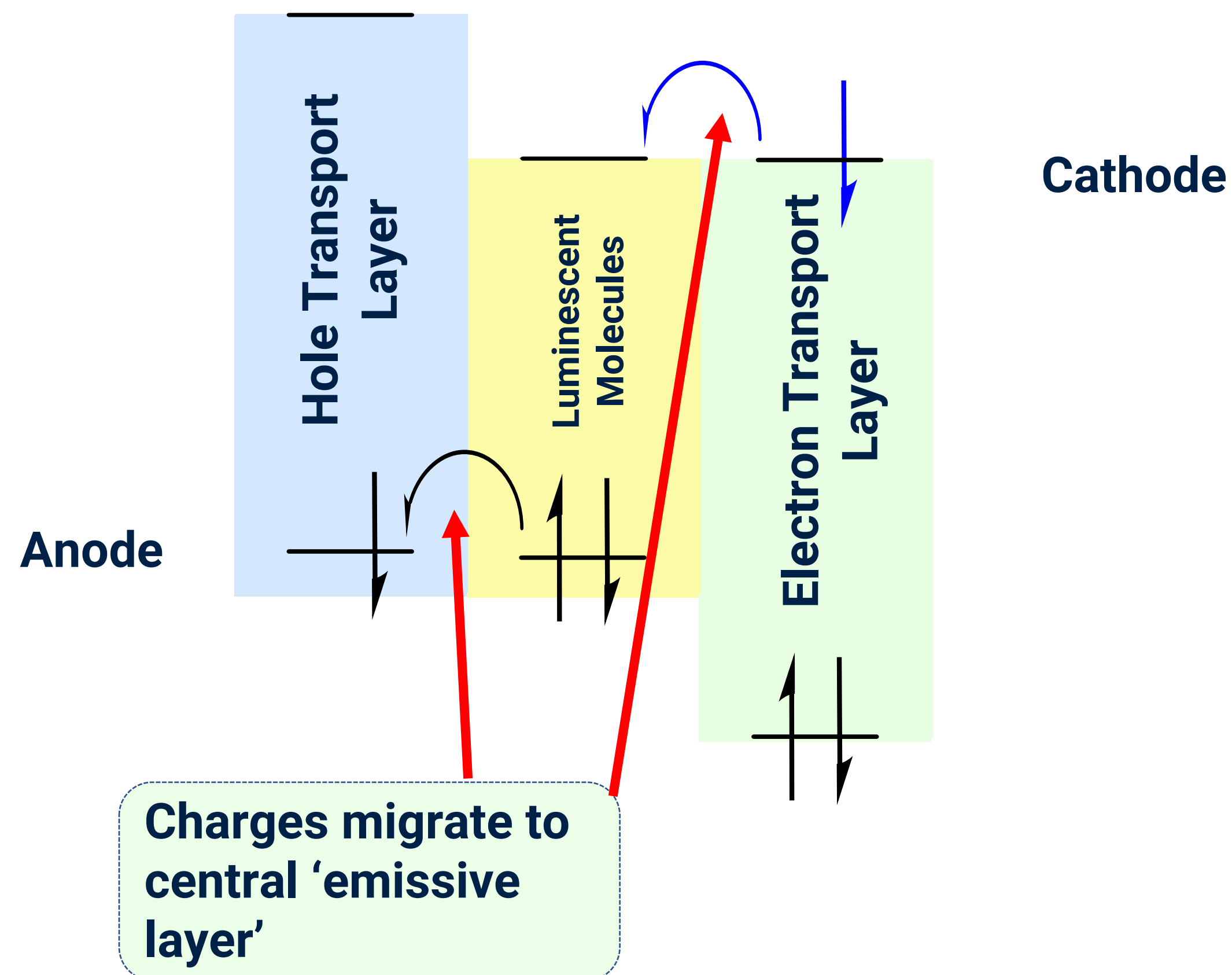
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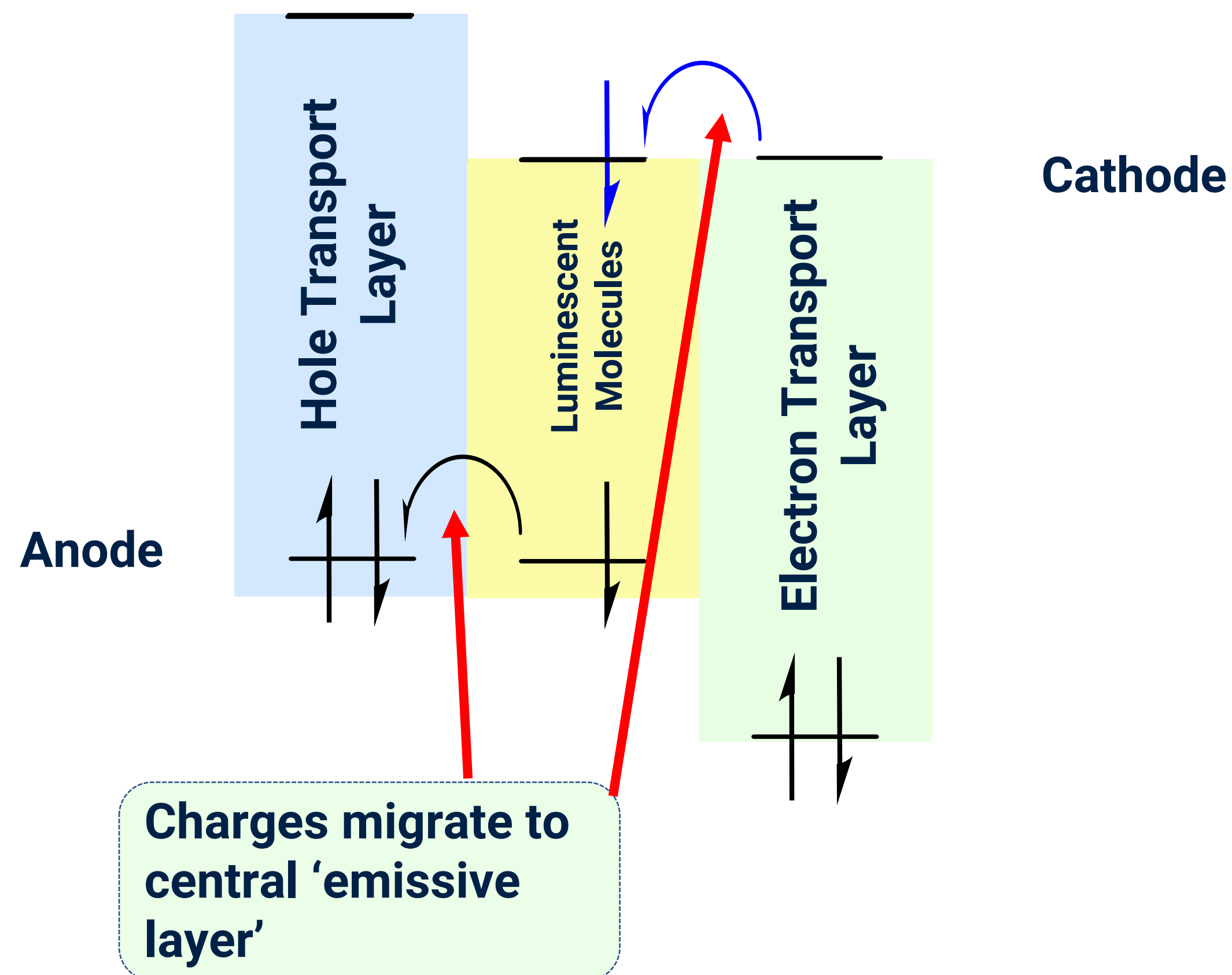
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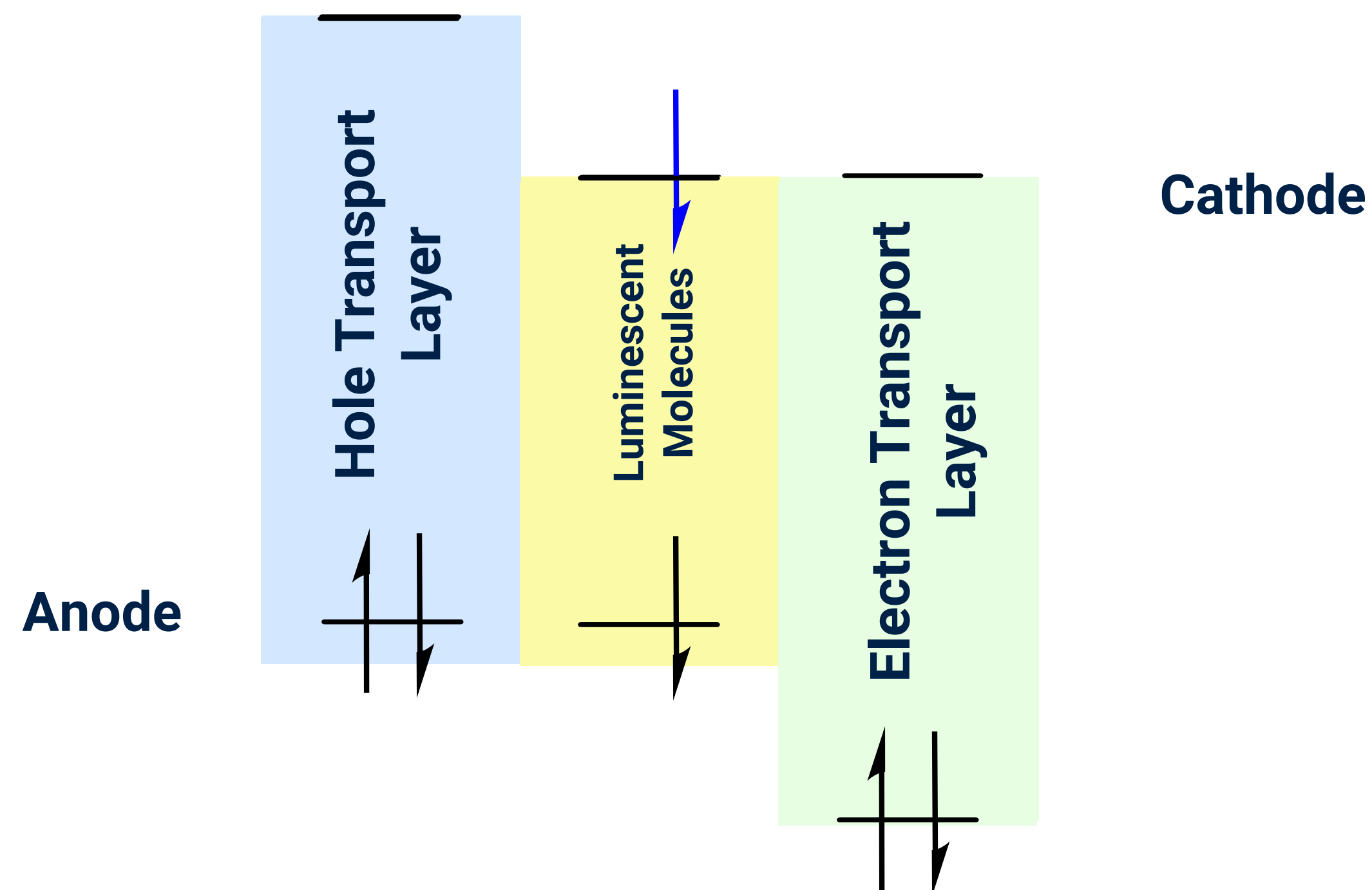
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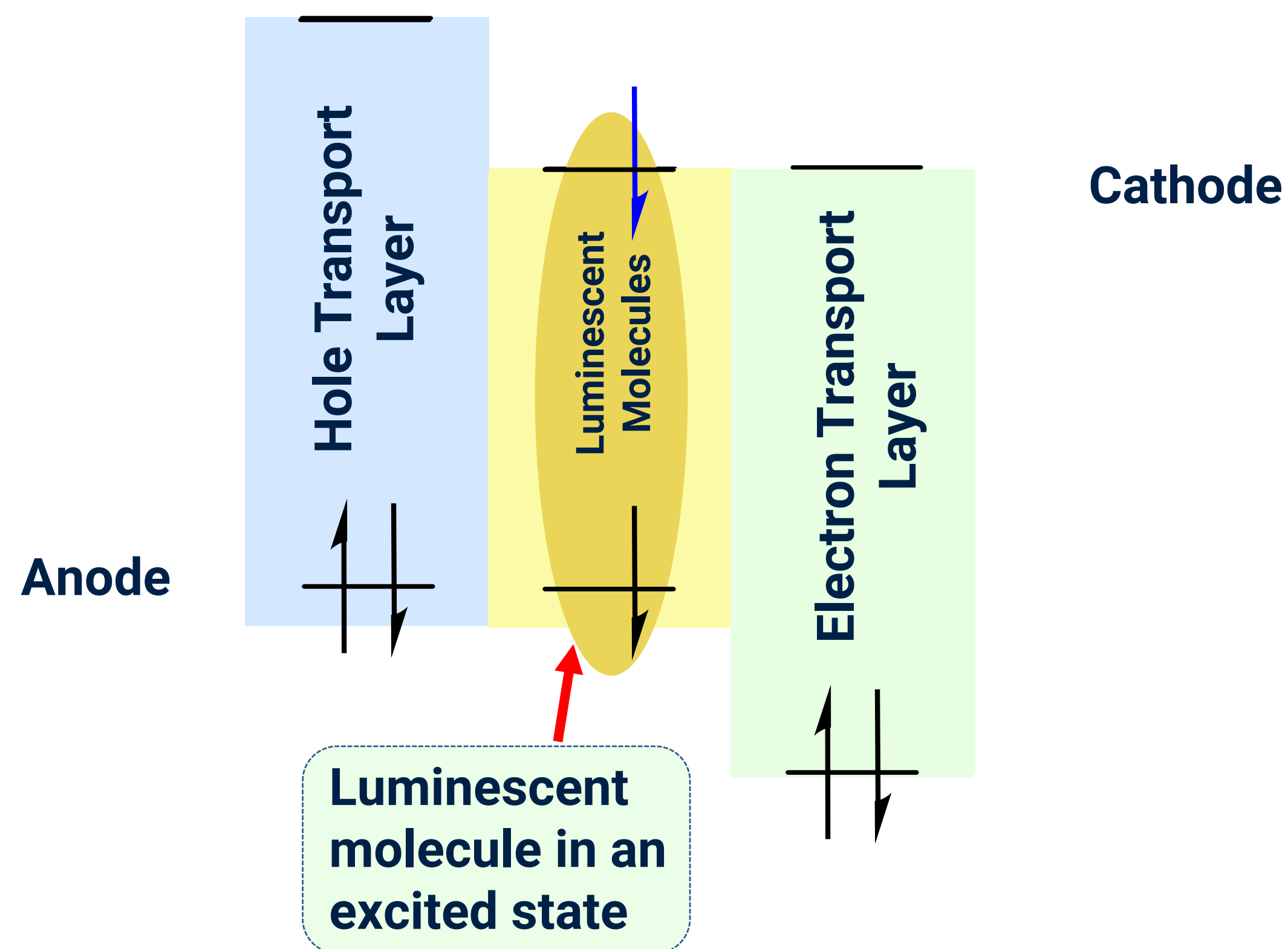
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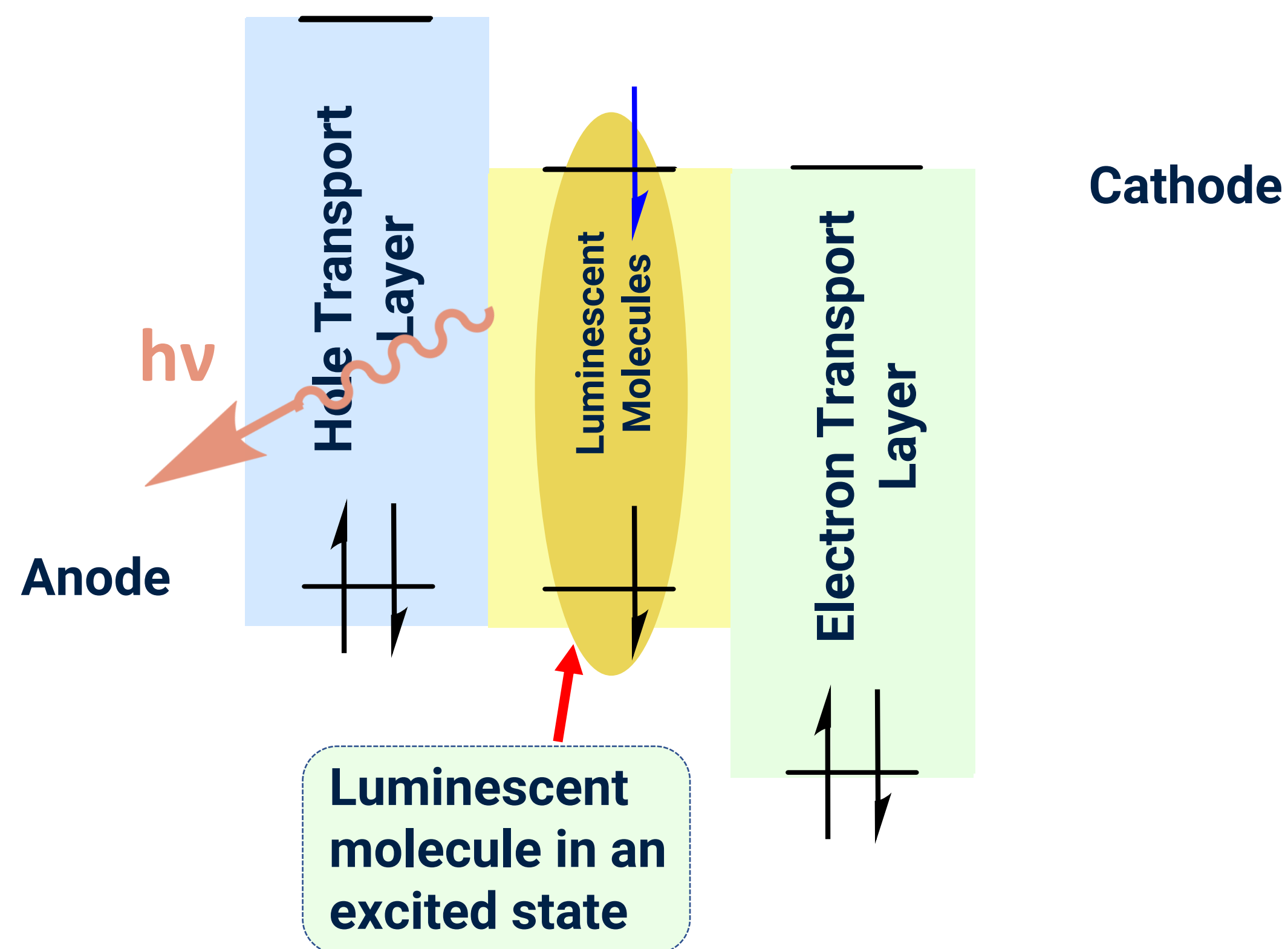
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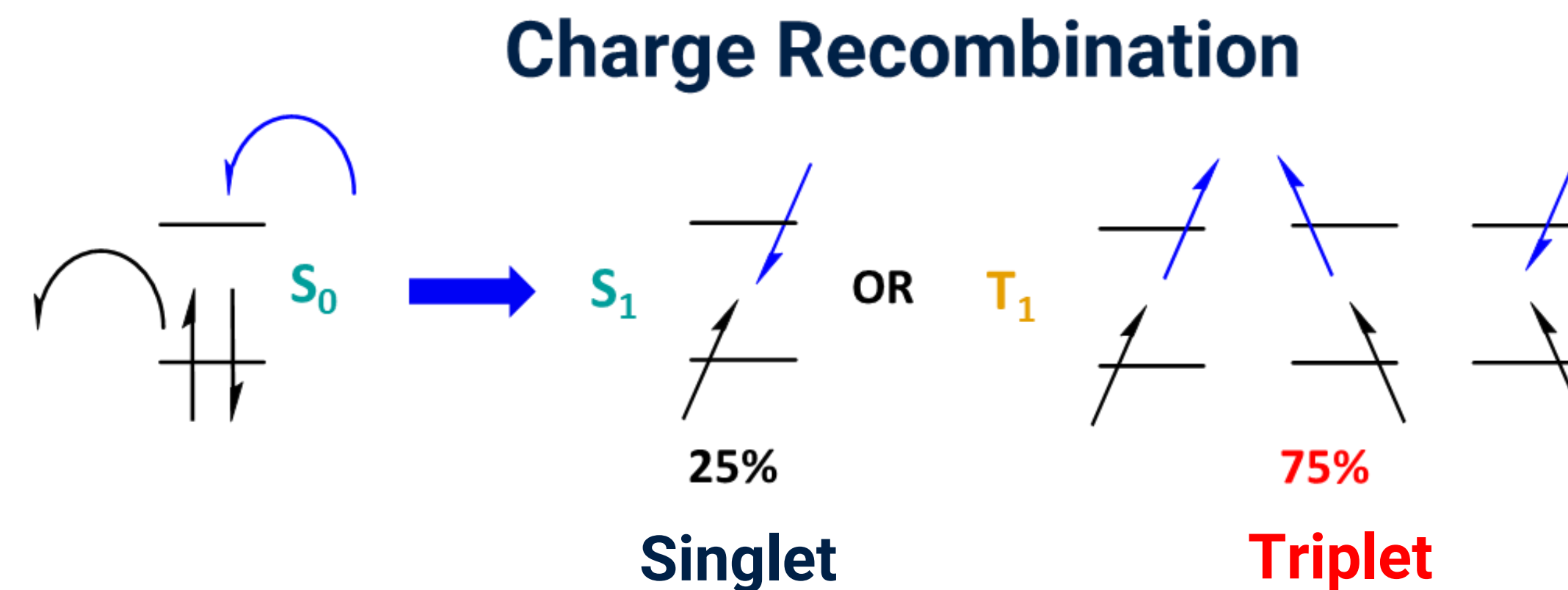
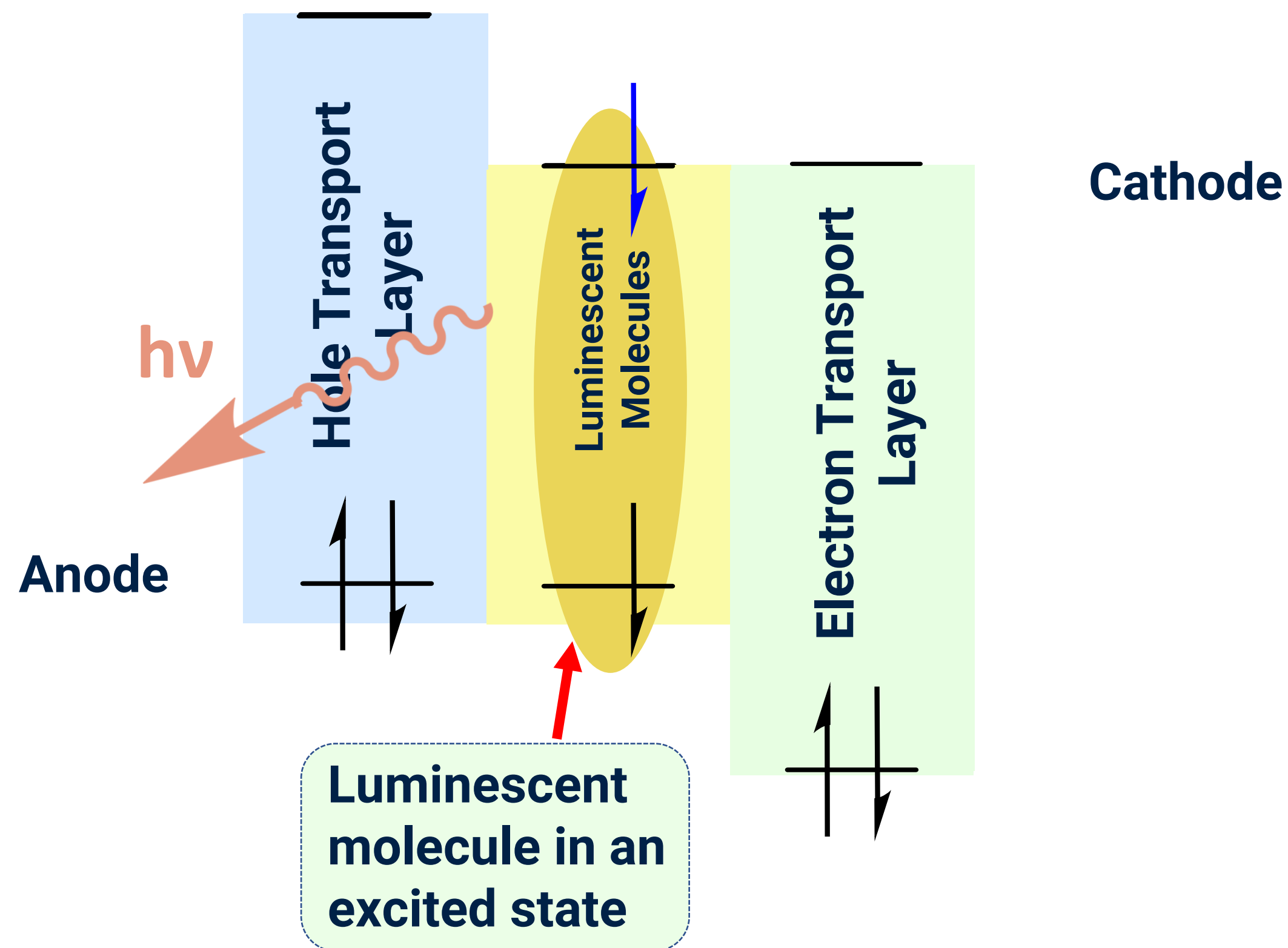
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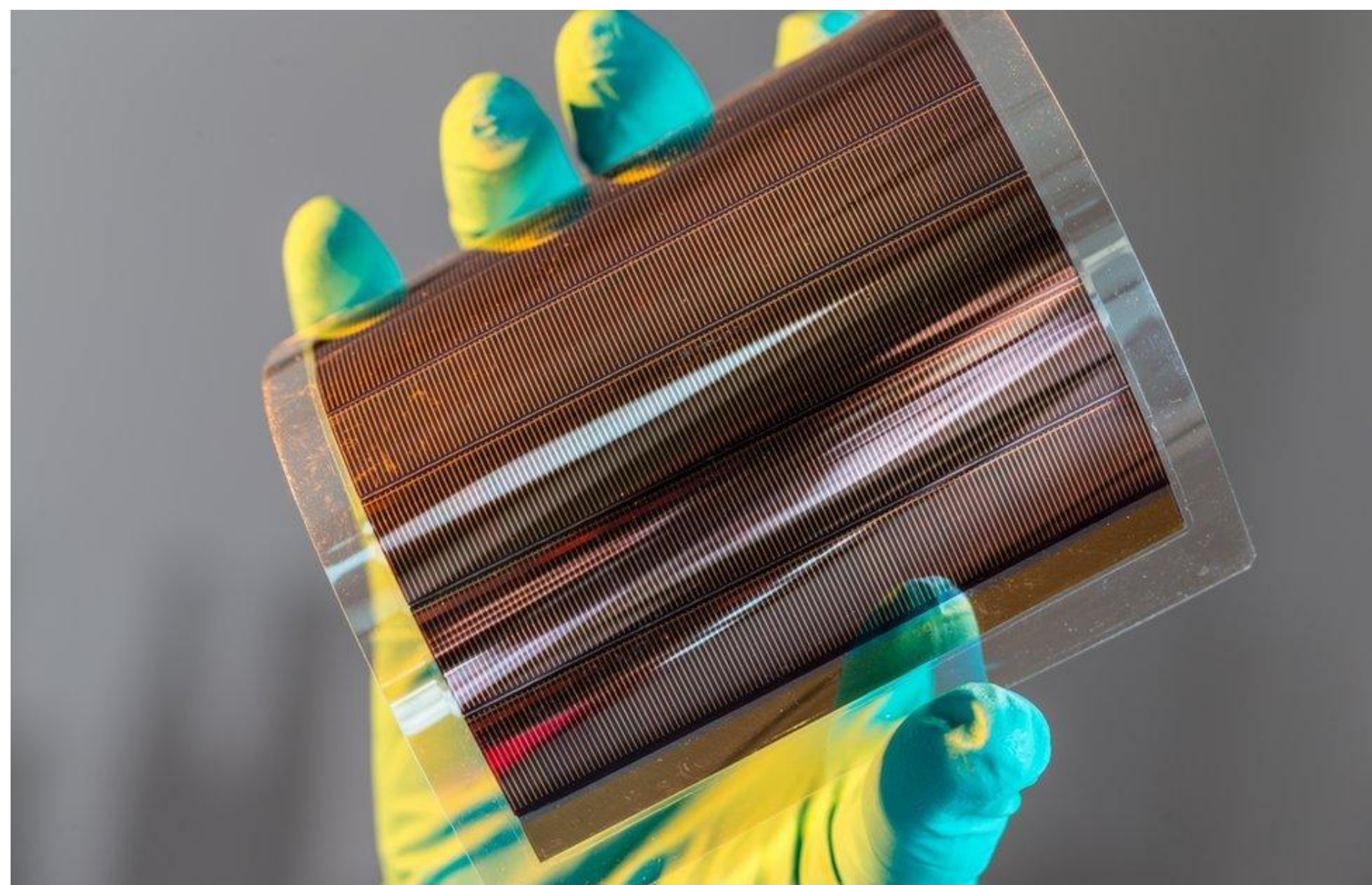


75% of the excited states formed in our OLEDs are triplets

Triplets are non-emissive

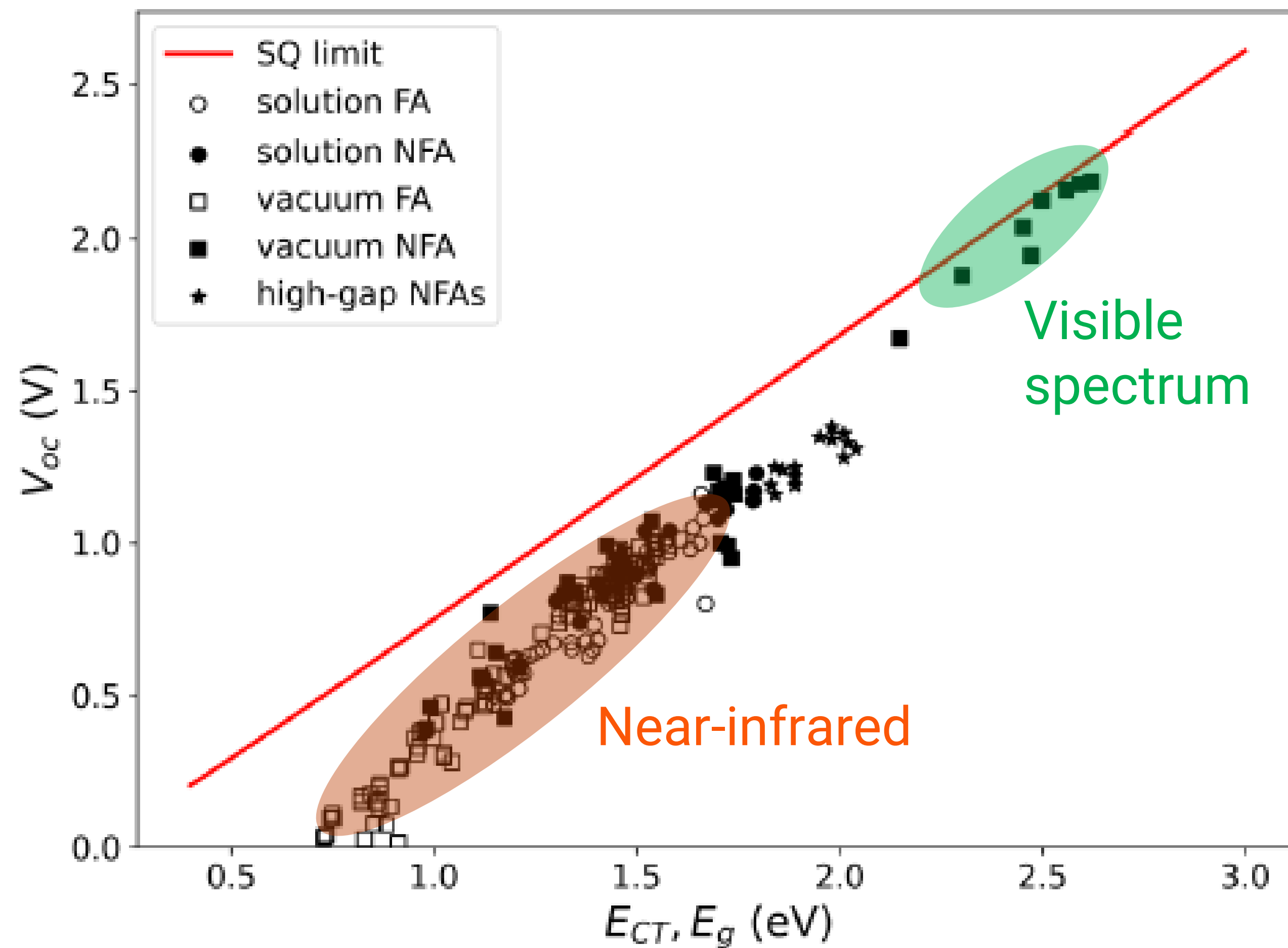
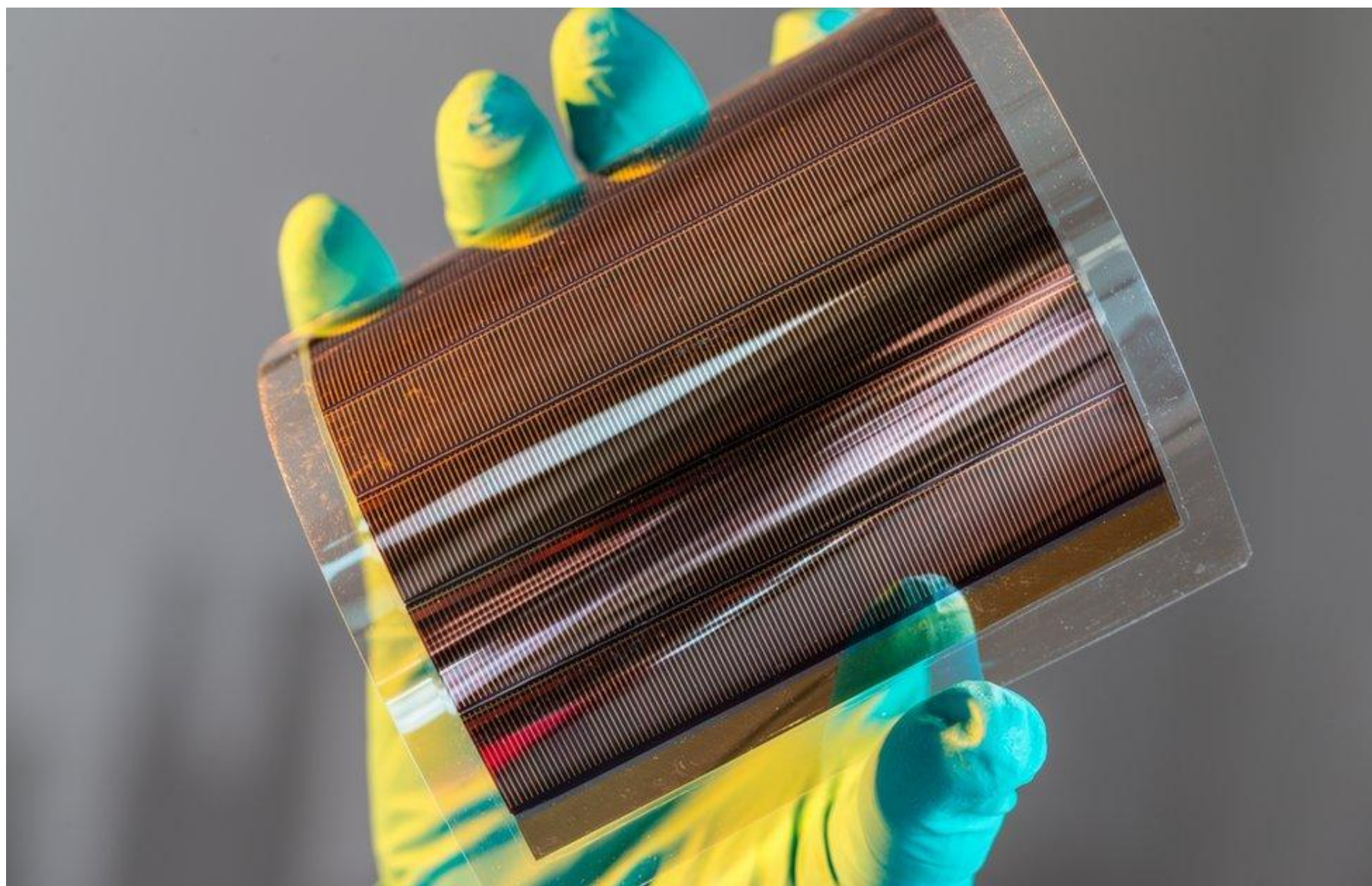
Organic Photovoltaics (OPVs)

If we have been able to commercialise OLEDs why not the inverse process of OPV?



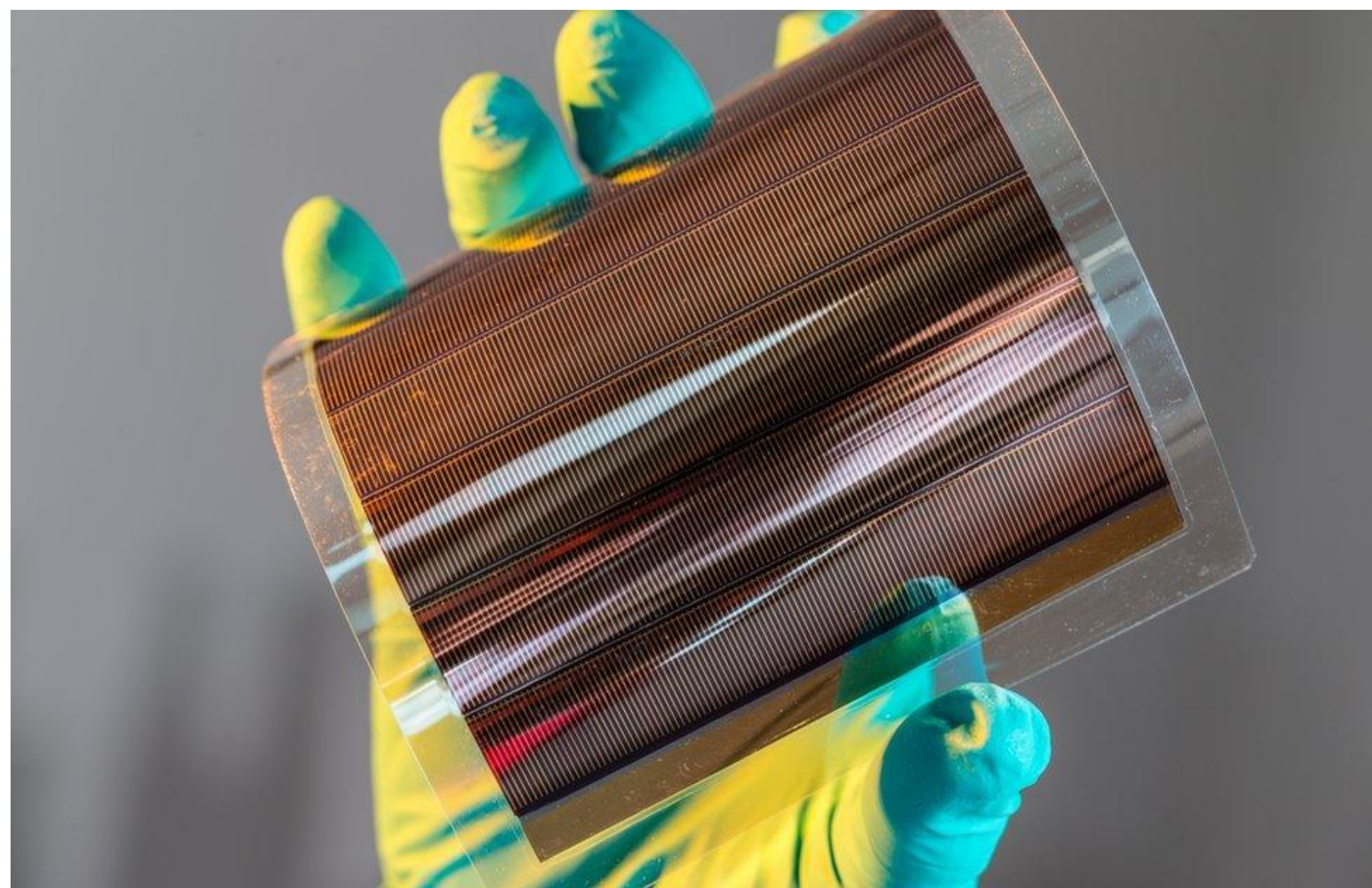
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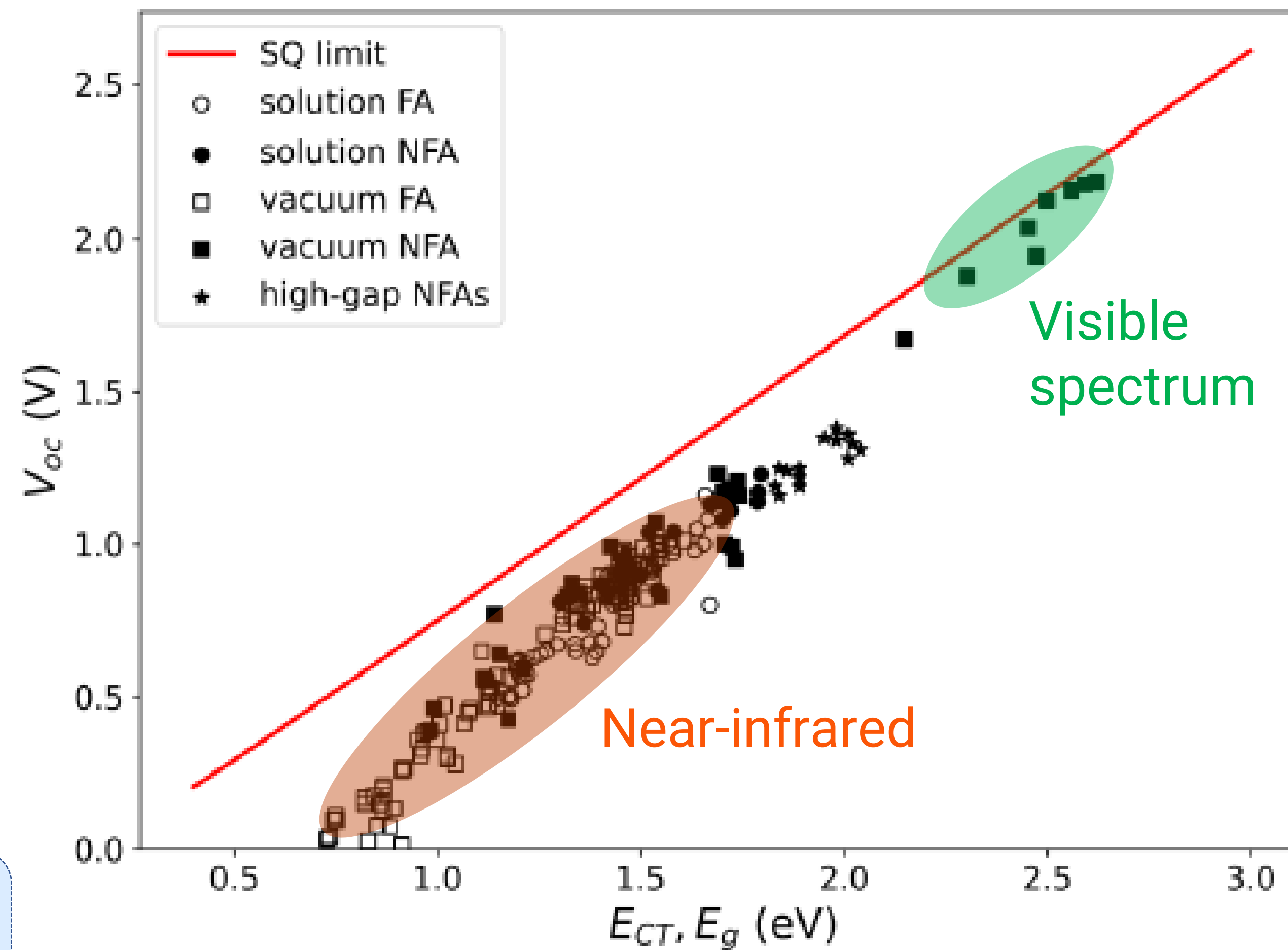


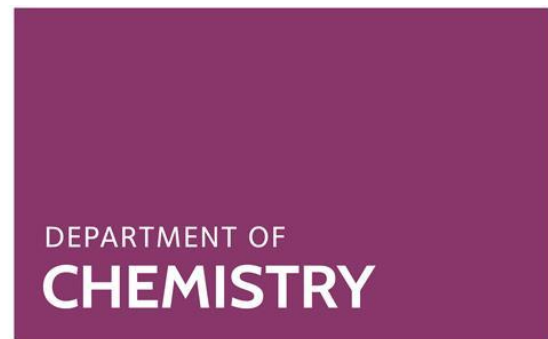
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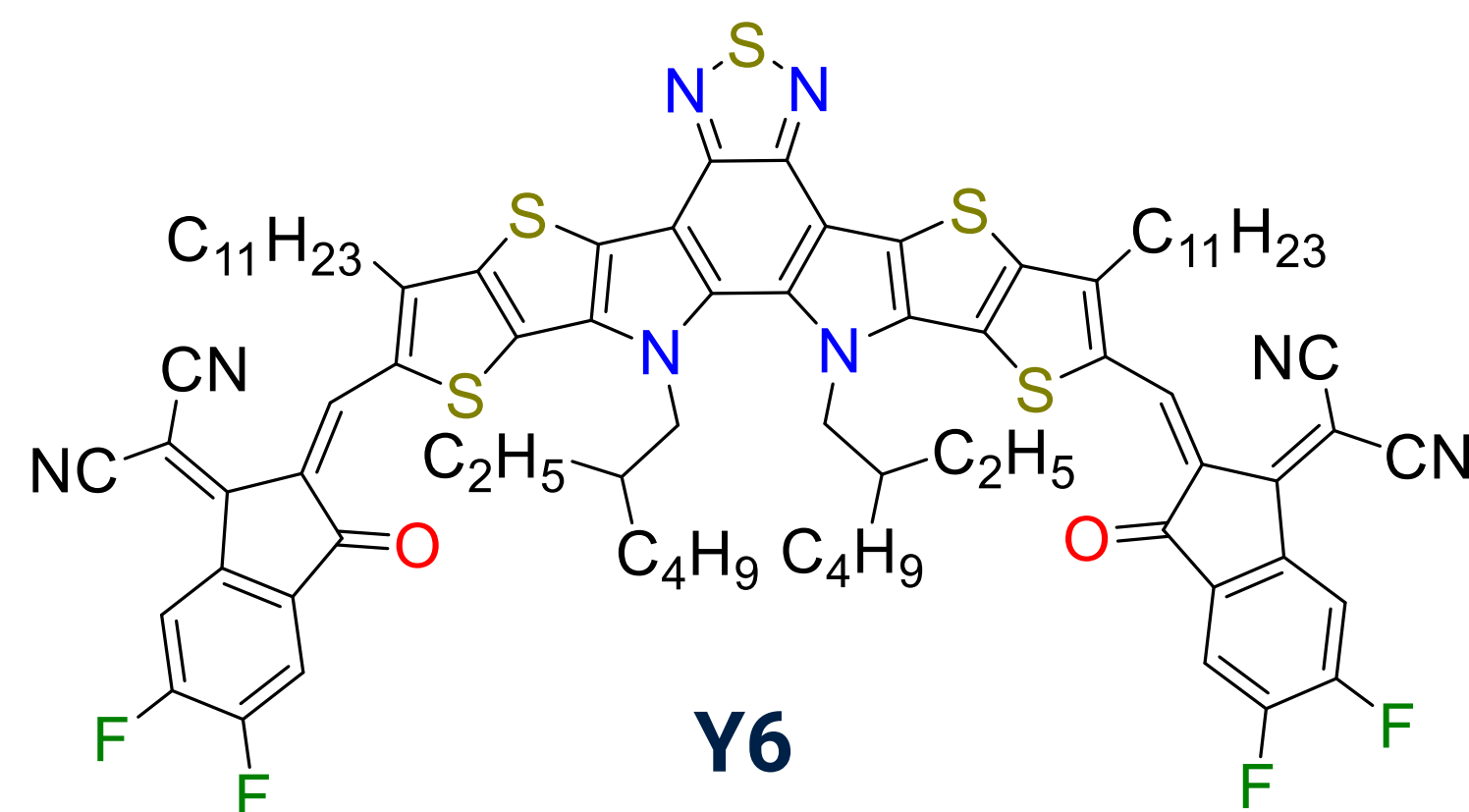
Non-radiative loss in near-infrared organics is a fundamental issue!



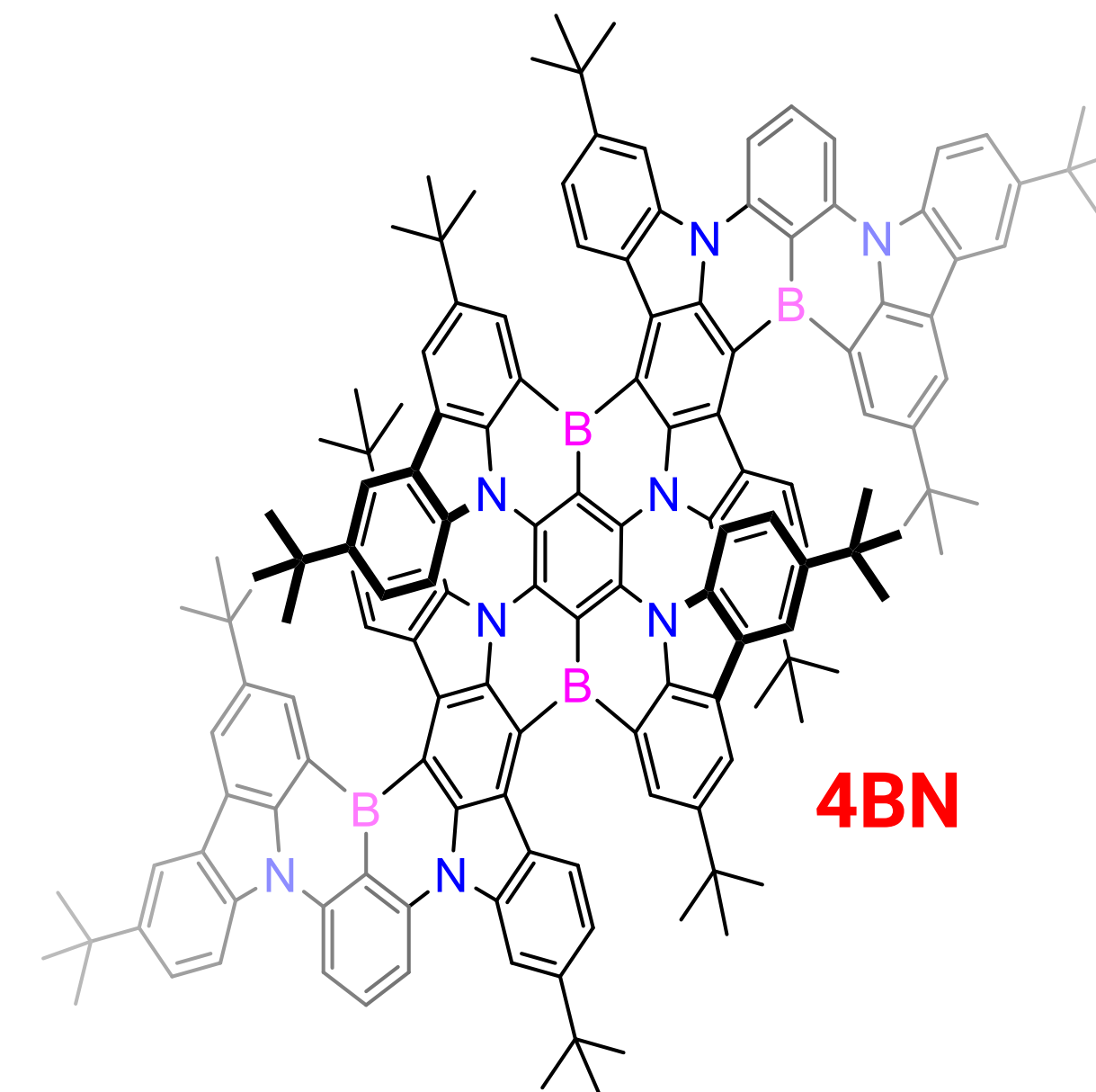
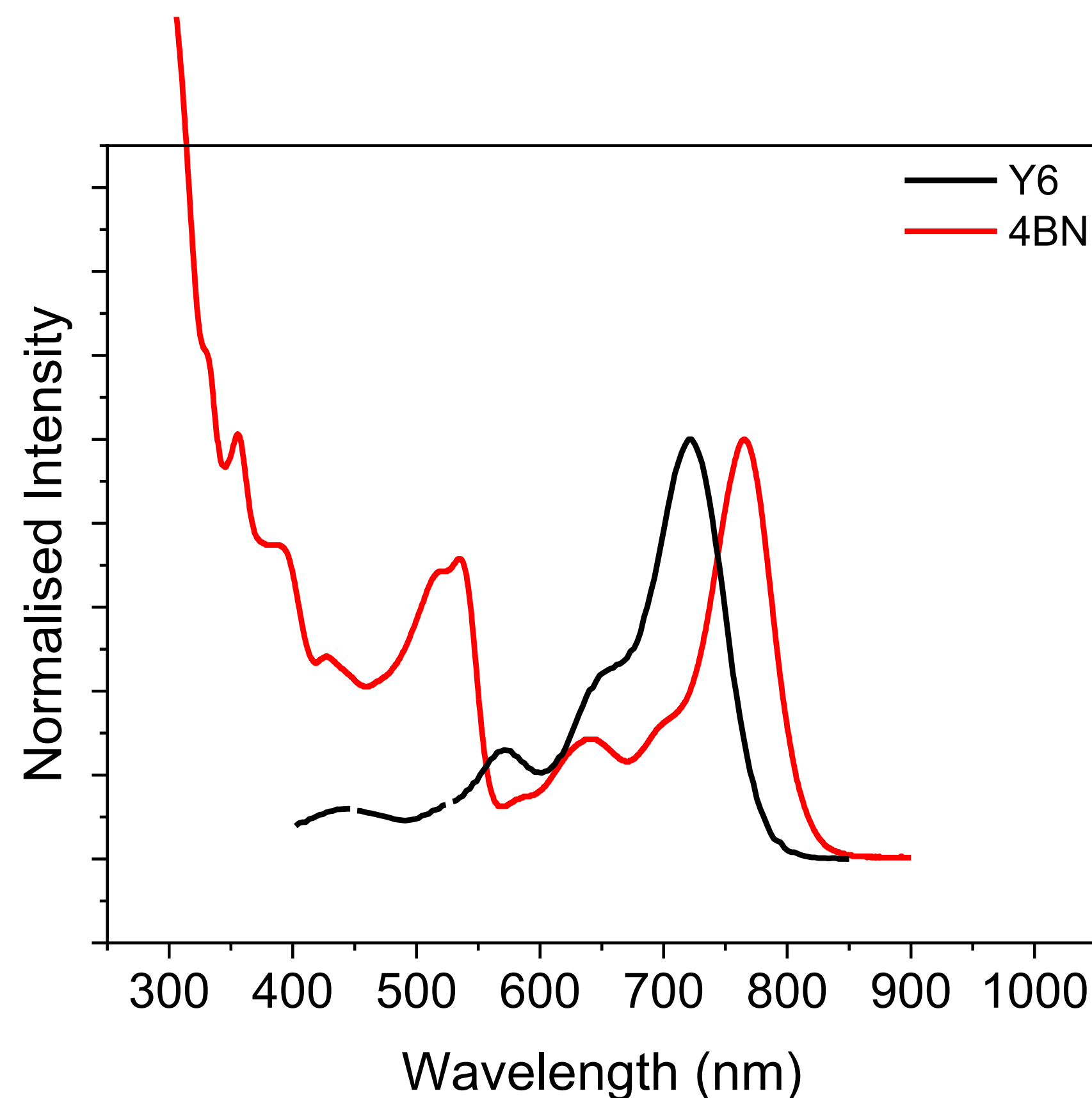


To Get Good Absorbers We Must Optimise Near-Infrared Emission!

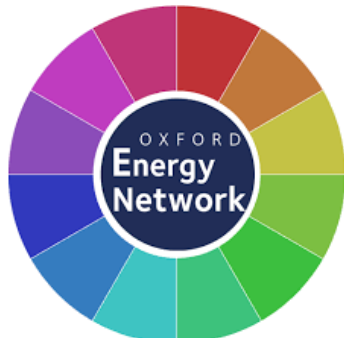
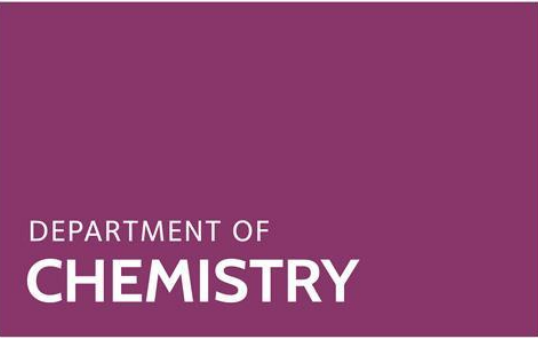
To Get Good Absorbers We Must Optimise Near-Infrared Emission!



Triplets are all dark
PLQY ~ 70%, max IQE ~ 18%



Triplets can be harvested
PLQY ~ 36%, max IQE ~ 36%



Thanks!



John Fell Fund

