Precise Control of Organic LED Emission Through Optically-Resonant Microcavity Confinement

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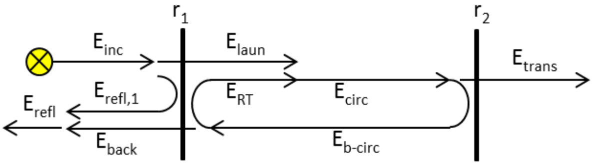
OLED Devices

Waveguides

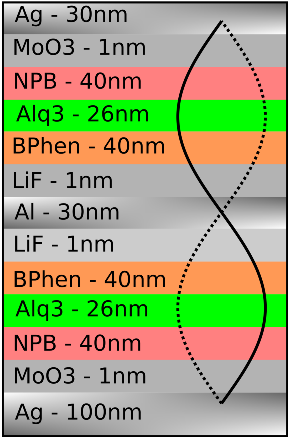
The Fabry-Pérot Etalon



$$T(\phi) = \frac{I_{trans}}{I_{inc}} = \frac{(1-R_1)(1-R_2)}{\left(1-\sqrt{R_1 R_2}\right)^2 + 4\sqrt{R_1 R_2}\sin^2(\phi)}$$

$$T_{\phi=0} = \frac{(1-R_1)(1-R_2)}{\left(1-\sqrt{R_1 R_2}\right)^2}$$

Microcavity-confined OLEDs

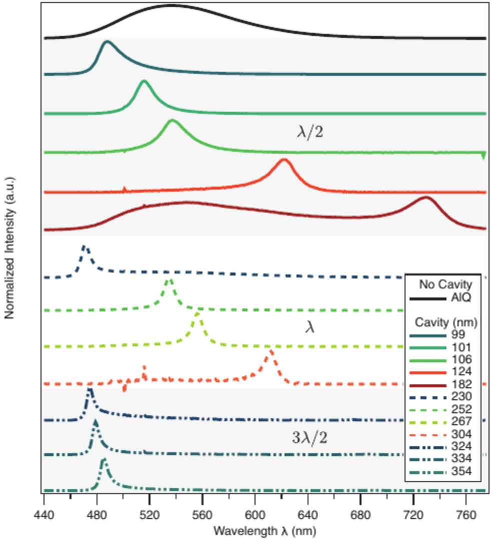


Device Fabrication

Angle-Resolved Electroluminescence Spectroscopy (ARES)

Single Cavity Devices

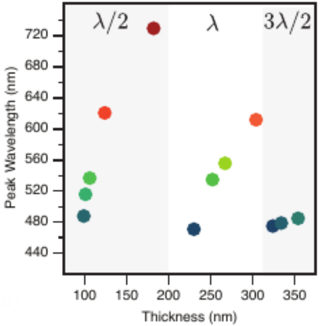
Test

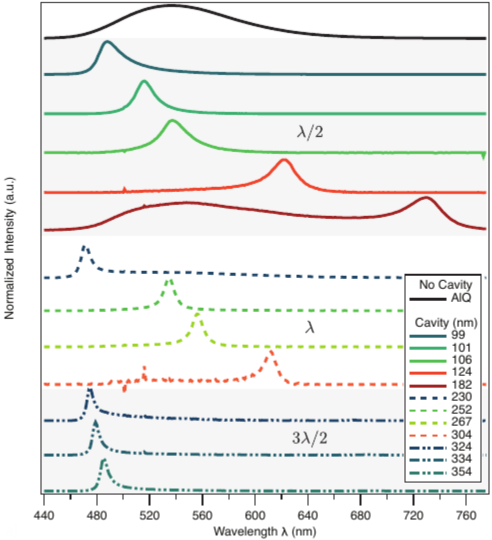


Peak Emission Wavelength

$$\lambda_0 = \frac{2nd}{q}$$

$n \rightarrow$ index of refraction
$d \rightarrow$ cavity thickness
$q \rightarrow$ resonant mode

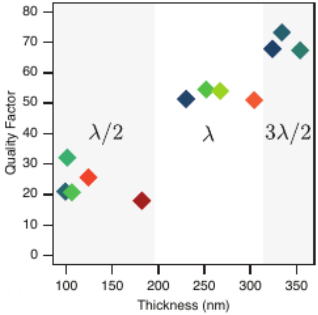


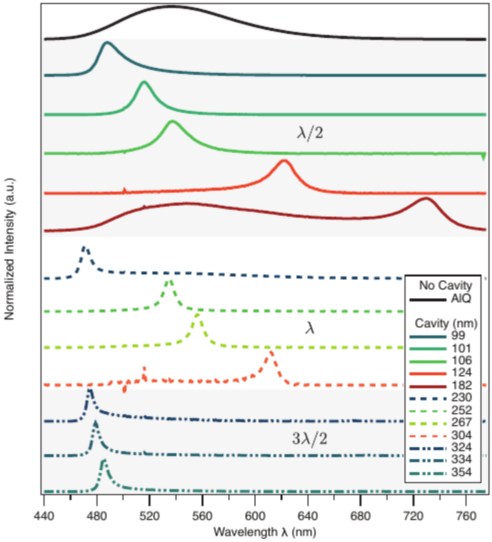


Band Narrowing

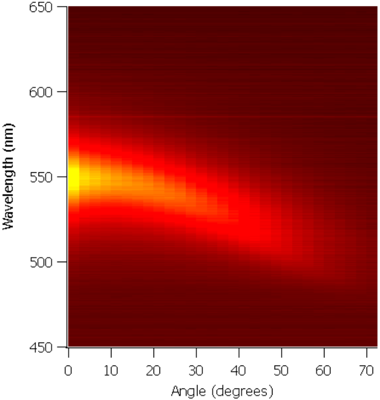
$$Q = \frac{2nd}{\lambda_0}\left\{\frac{1-\sqrt{R_1R_2}}{\pi(R_1R_2)^{1/4}}\right\}$$

$$Q = q\left\{\frac{1-\sqrt{R_1R_2}}{\pi(R_1R_2)^{1/4}}\right\}$$

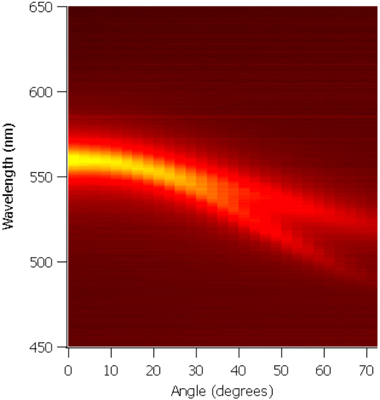




Effect of Bottom Electrode Material



Aluminum bottom electrode

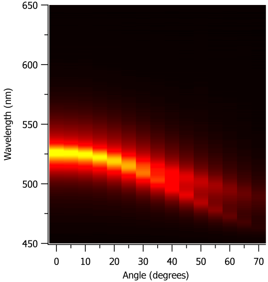


Silver bottom electrode

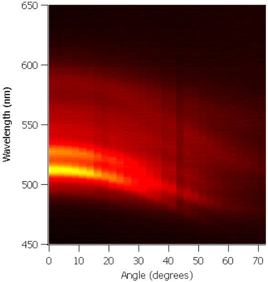
Multi-cavity Devices

Behavior at Large Angles

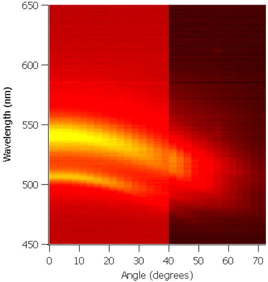
N=2 cavities



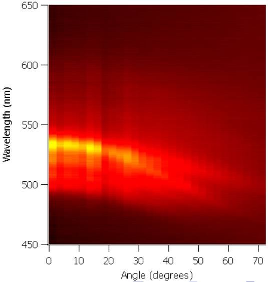
N=3 cavities



N=4 cavities

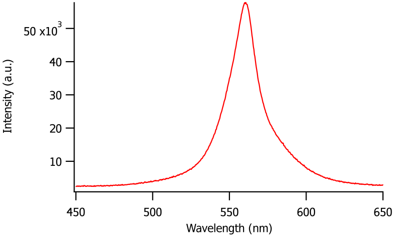


N=5 cavities

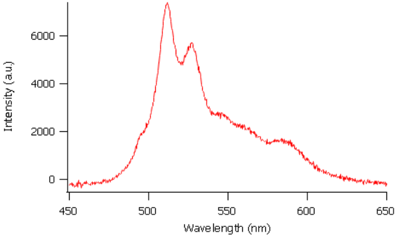


Number and Bandwidth of Resonant Modes

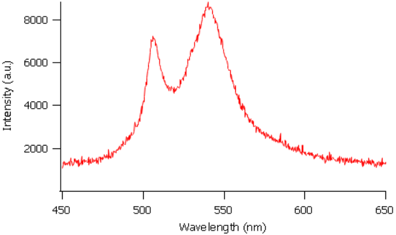
N=2 cavities



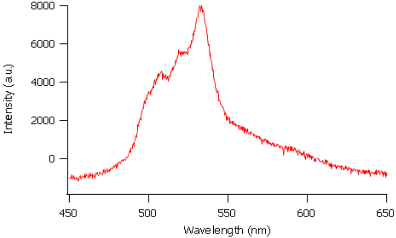
N=3 cavities



N=4 cavities



N=5 cavities



Conclusions and Future Work

References

Aknowledgements

Questions?