Accelerated Aging Testing of Phosphors in Remote wLED Configuration

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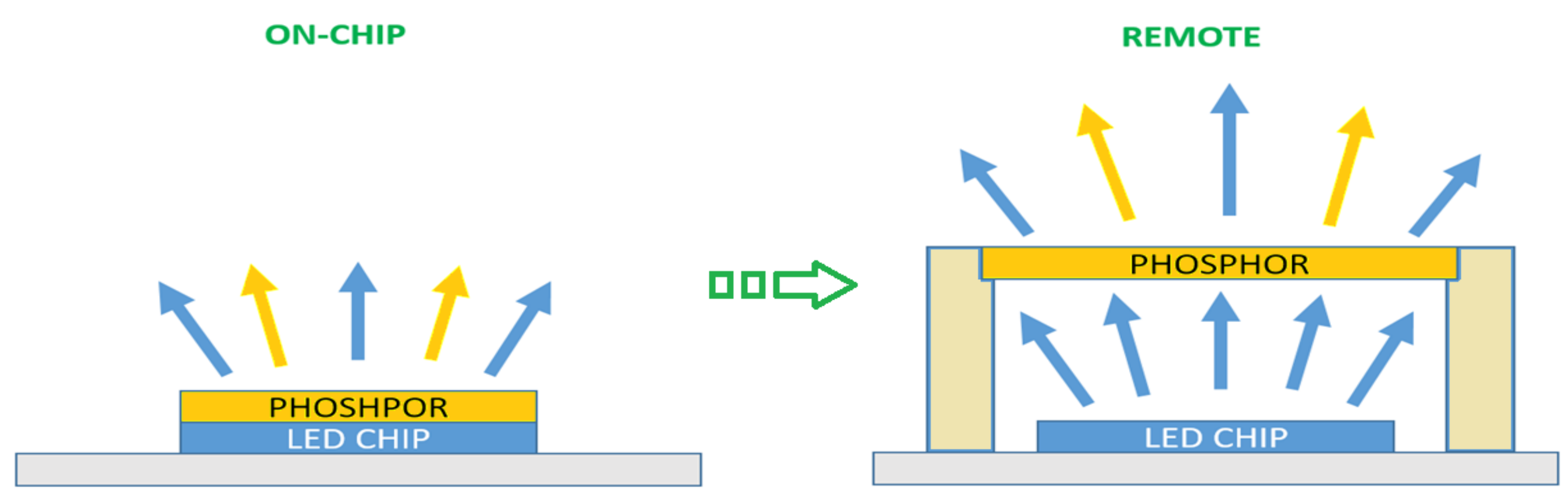
LEDs For a Bright Future

- Excellent optical quality
- High efficiency
- High reliability
- Environmentally friendly

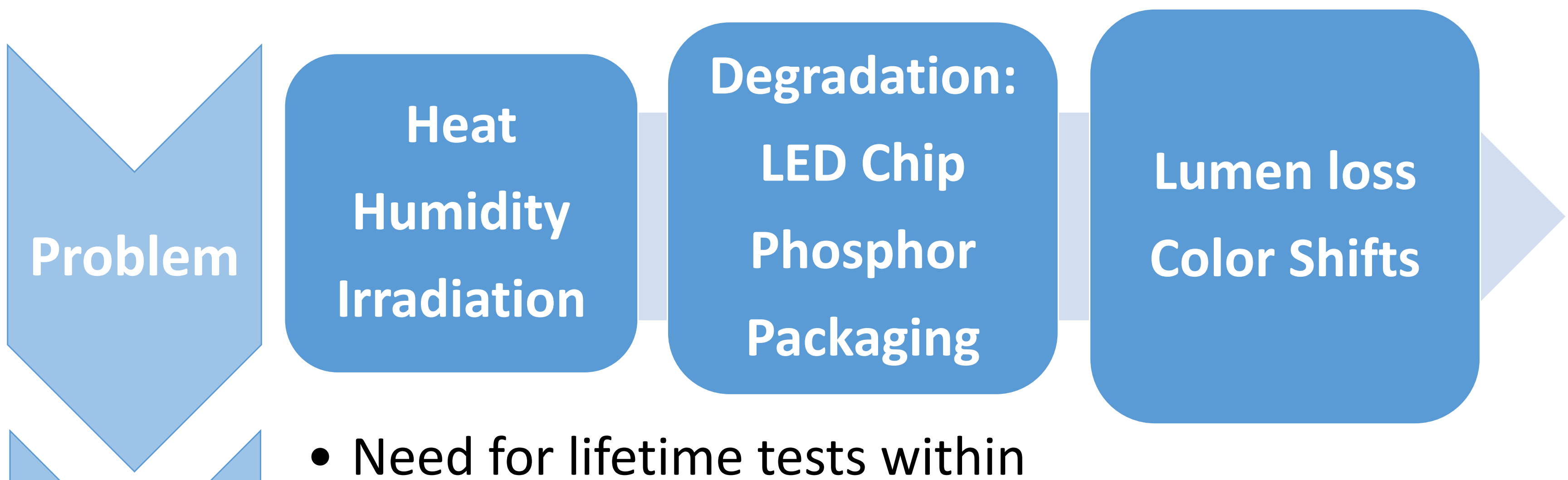
Remote Phosphor Converted wLEDs



Effect on lifetime

- Increased uniformity
- **Lower temperature**
- **Lower irradiance flux**

Towards Long-term Stable Devices



Heat
Humidity
Irradiation

Degradation:
LED Chip
Phosphor
Packaging

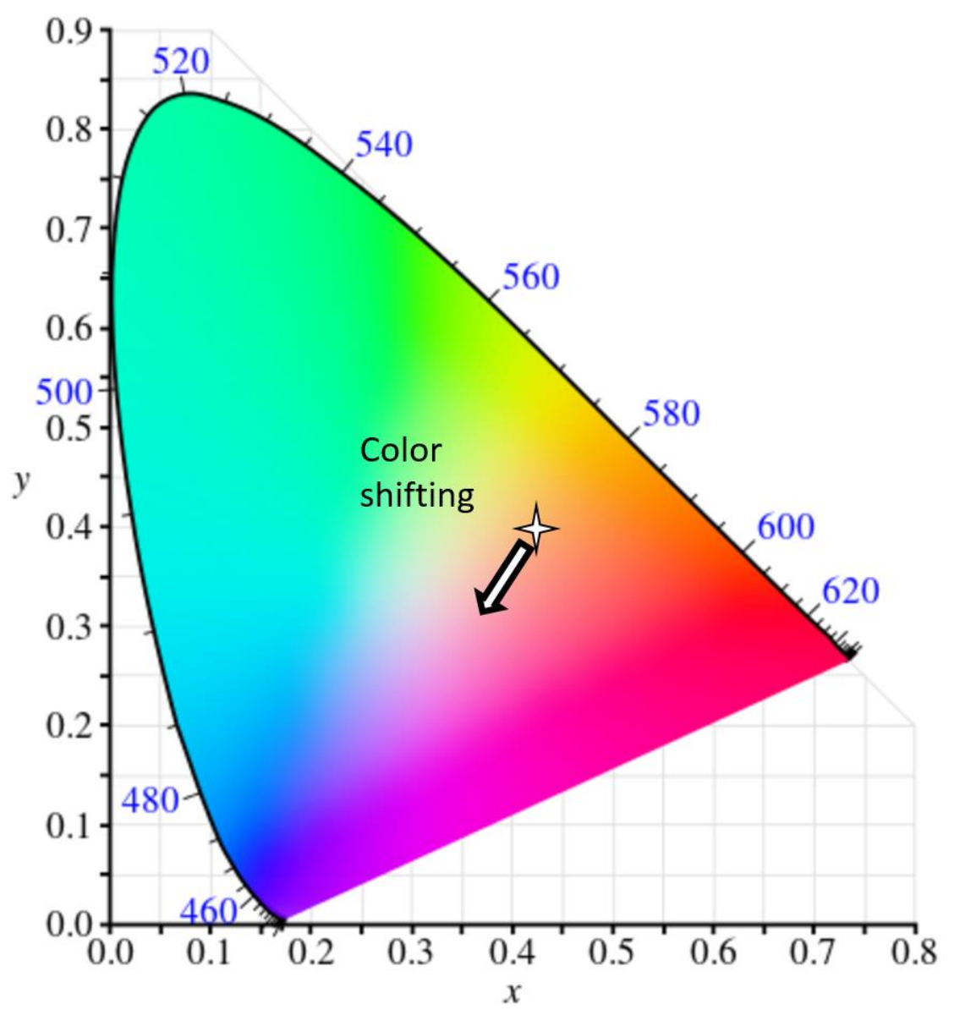
Lumen loss
Color Shifts

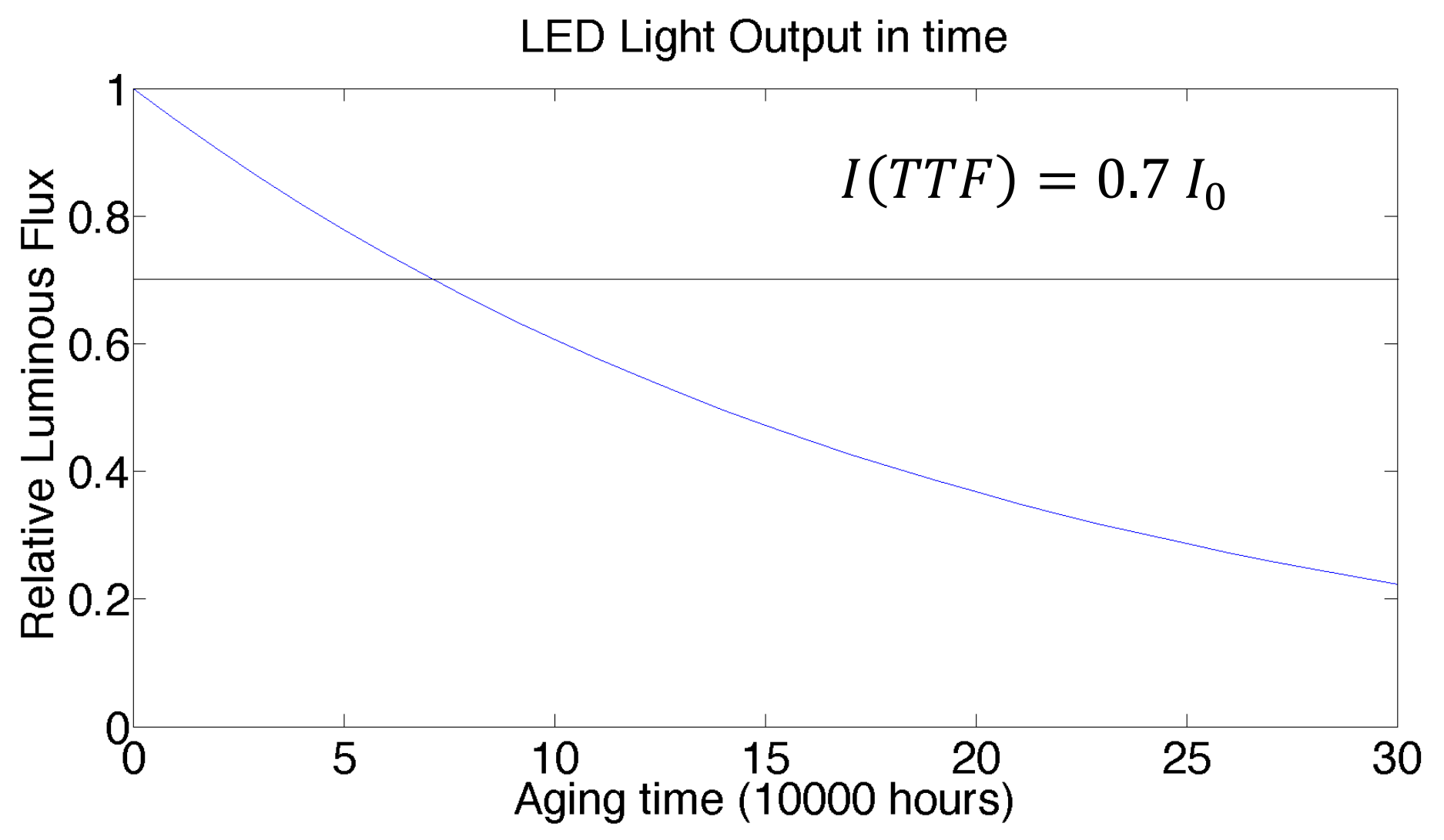
Challenge

- Need for lifetime tests within reasonable timespan
- Only introduce degradation mechanisms that occur under normal operating conditions

Solution

- **Accelerated Aging Tests**
  - High heat
  - High humidity
  - High irradiance flux




LED Light Output in time

Lifetime Prediction of LEDs

Exponential luminous decay equation:

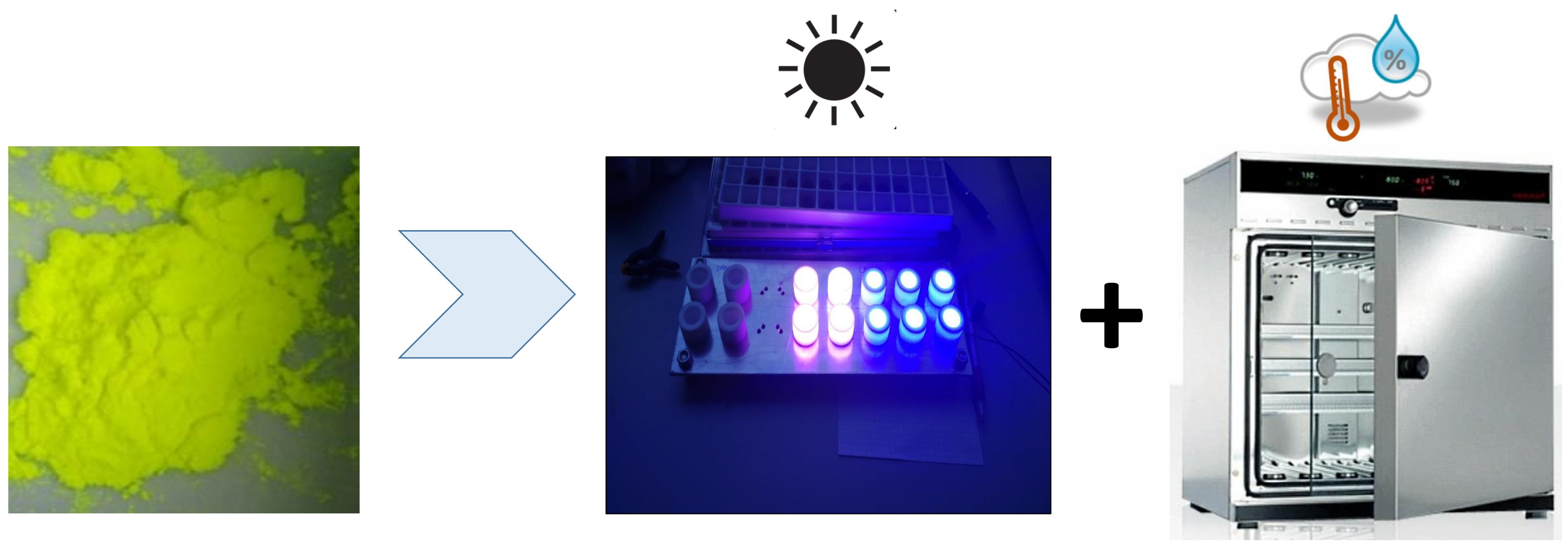
$$\varphi(t) = \beta e^{-\alpha t}$$

$$\alpha = e^{-\left[E_a/_{kT}\right]}$$

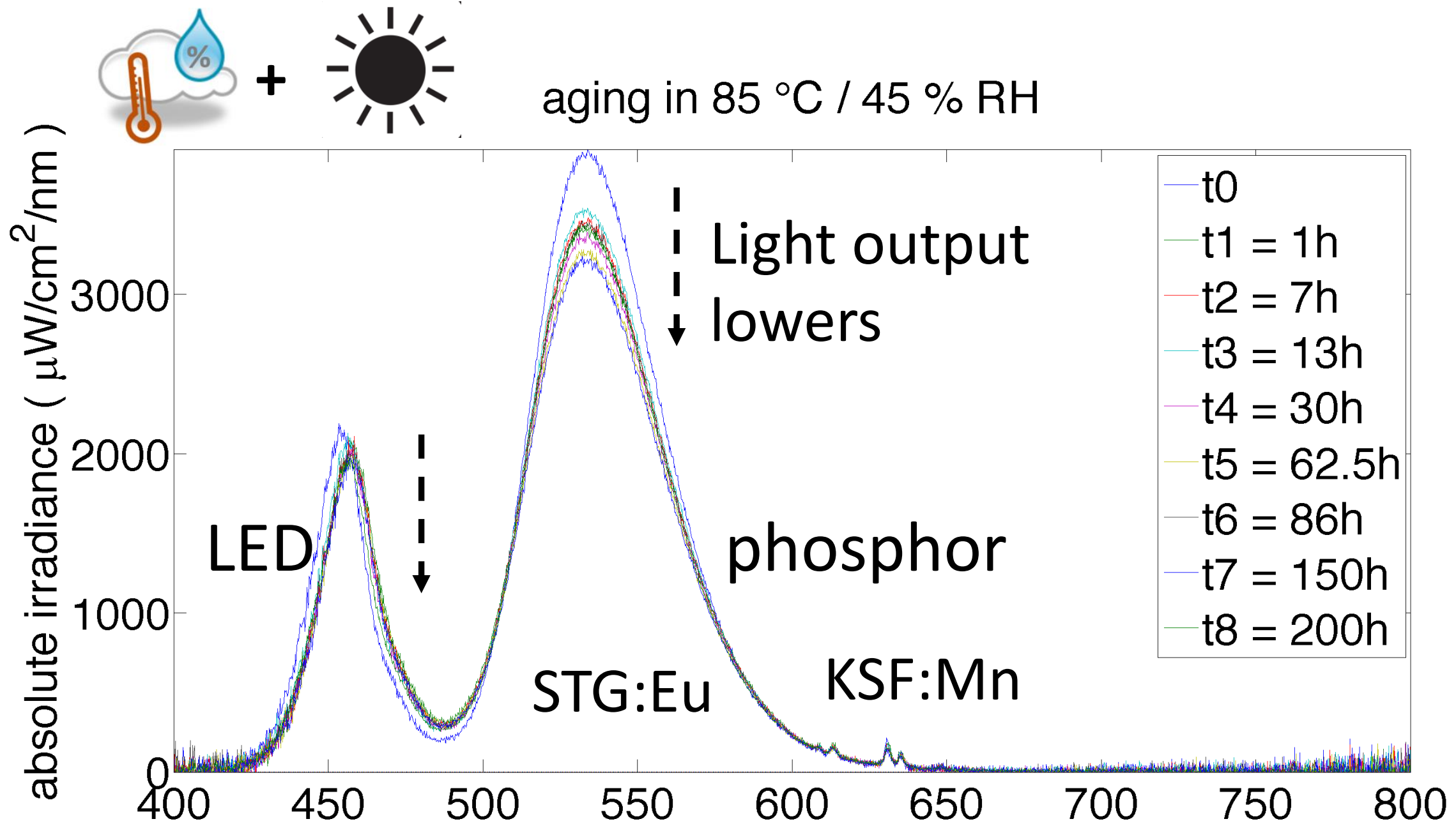
φ: lumen output

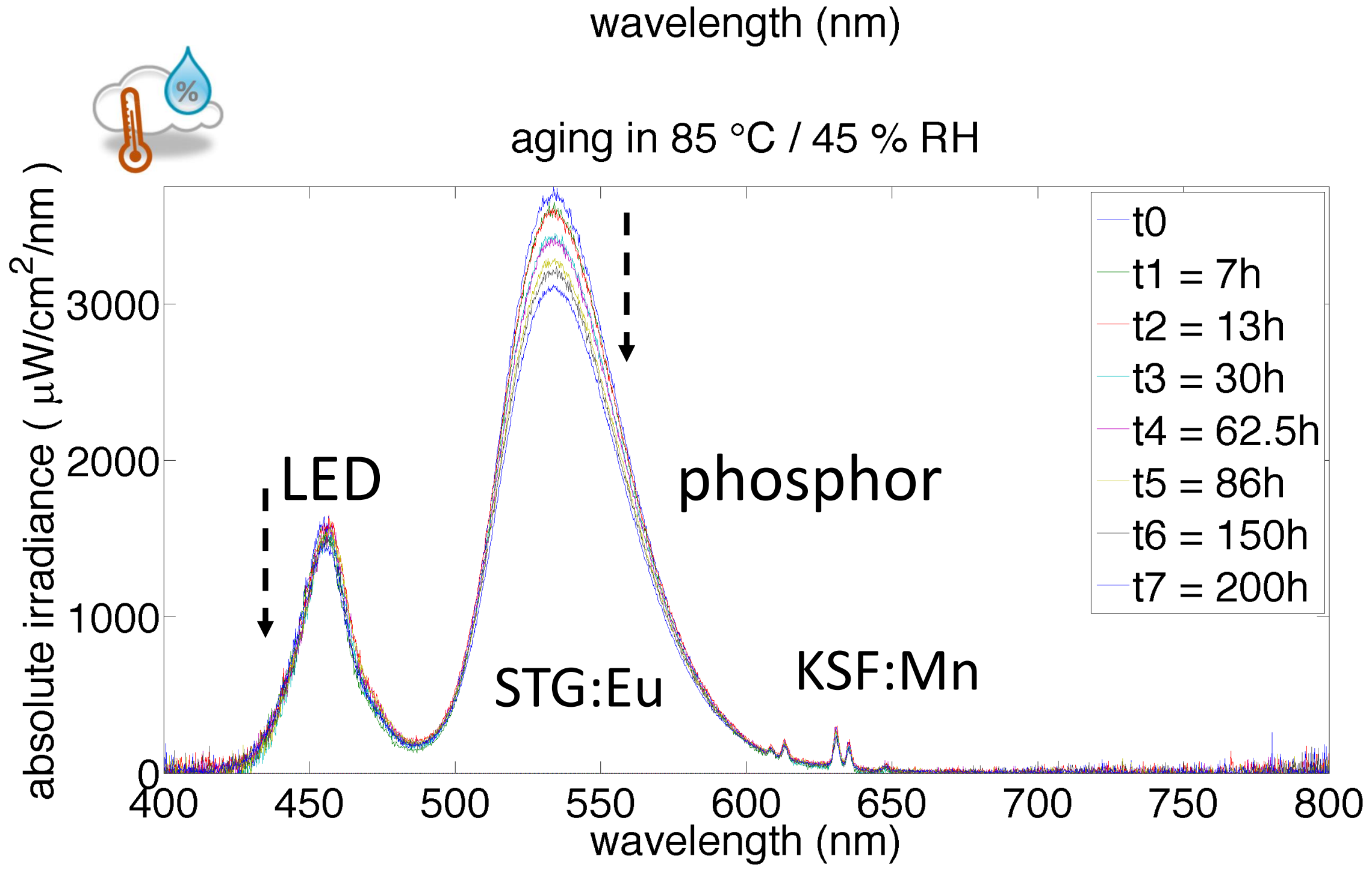
α: degradation reaction rate parameter

Experimental Setup

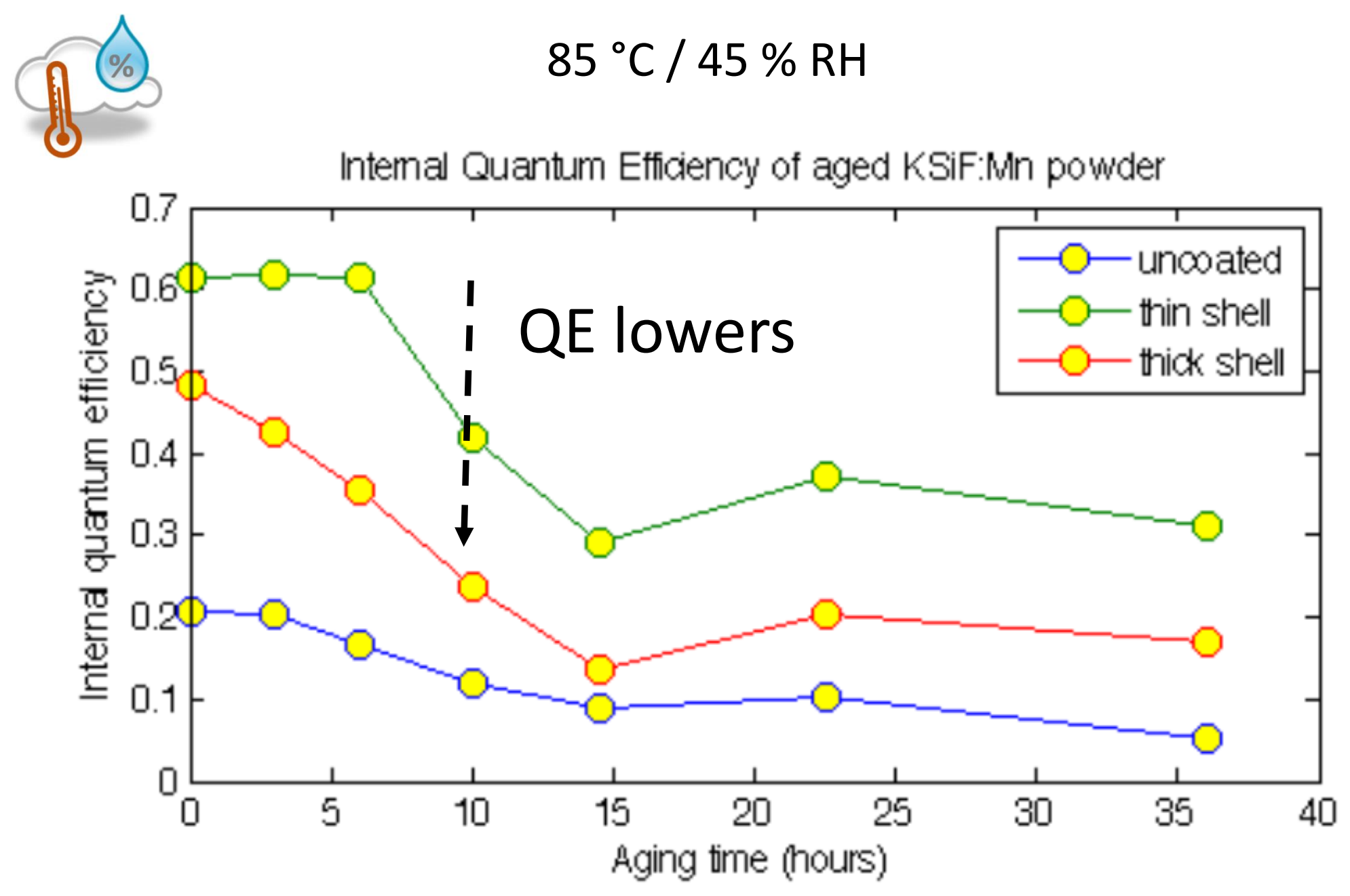


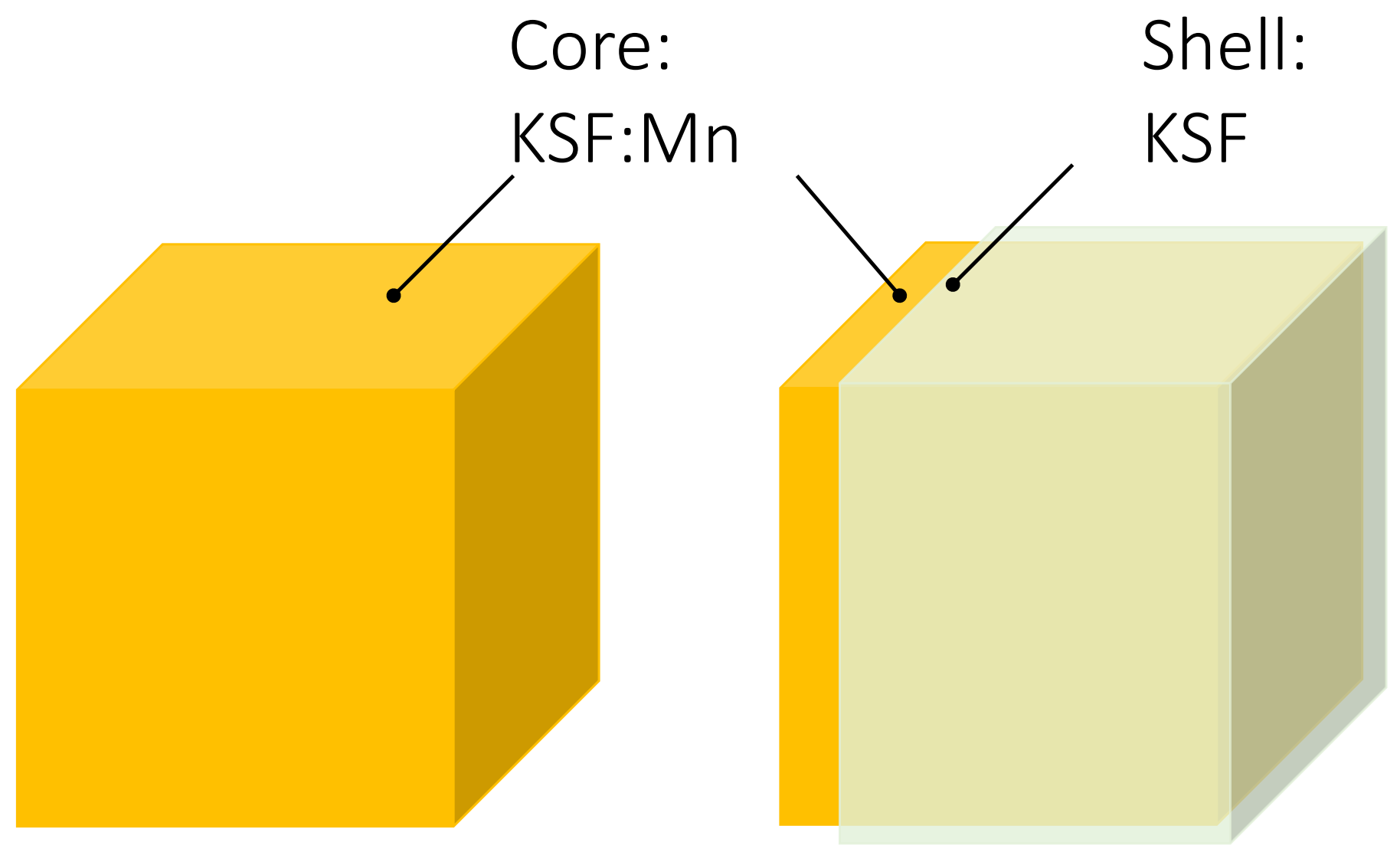
Phosphor Plate Degradation





Light Conversion





Host Crystallinity