Using UV-A to your Advantage: Black & White Edition

May 7, 2018

UV LED Technology Mission

RADTECH UV+EB 2018

Convert Legacy Technology to Solid-State While Enabling New Applications

UV LED Technology

Higher Performance
Better Control
More Efficient
Better for Environment
Small Footprint

Phoseon Developed and Leads the Market

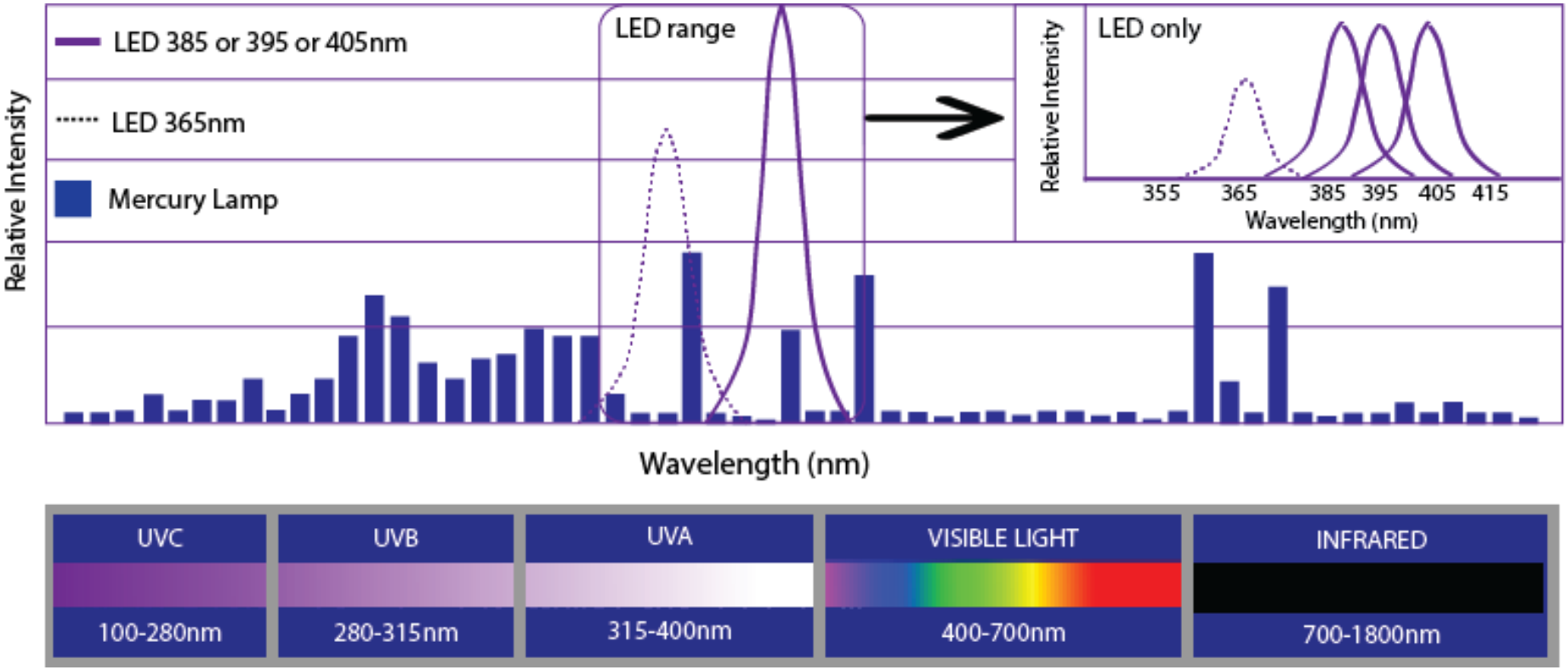
Is UV LED right for me?

1. Do you currently UV cure ?
2. Have you calculated how much downtime is associated with your current equipment?
3. Do you have “a guy” handle your constant mercury lamp issues?

- Are you currently using water based of solvent chemistry?
  - Ovens take up space and are expensive
  - Regulatory pressures likely to tighten in the coming years

- What was true years ago may no longer be true ?
  - LED is slow
  - I don’t want to carry two ink sets
  - Surface cure
  - It’s too expensive
  - Technology isn’t ready….

LED Wavelength…today & tomorrow



Inks, Coatings and Adhesives available today are formulated to take advantage of High UV-A wavelength

Wavelength…High UV-A

Nanometer = one billionth of a meter

How High UV-A can help you TODAY

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Proven and available right now

More Efficient

- Eliminates unplanned line stoppages experienced with arc lamps
- Instant ON/OFF
- Less scrap

More Reliable

- Short runs
- Quick job changes
- Less maintenance benefits JIT deliveries
- Stable & consistent UV LED output

More Repeatable

- Consistent curing
- Predictable
- Reliable
- Less waste

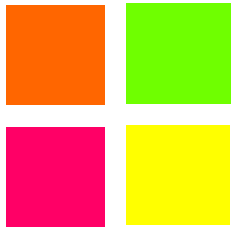
Adjust configurations to the most demanding applications

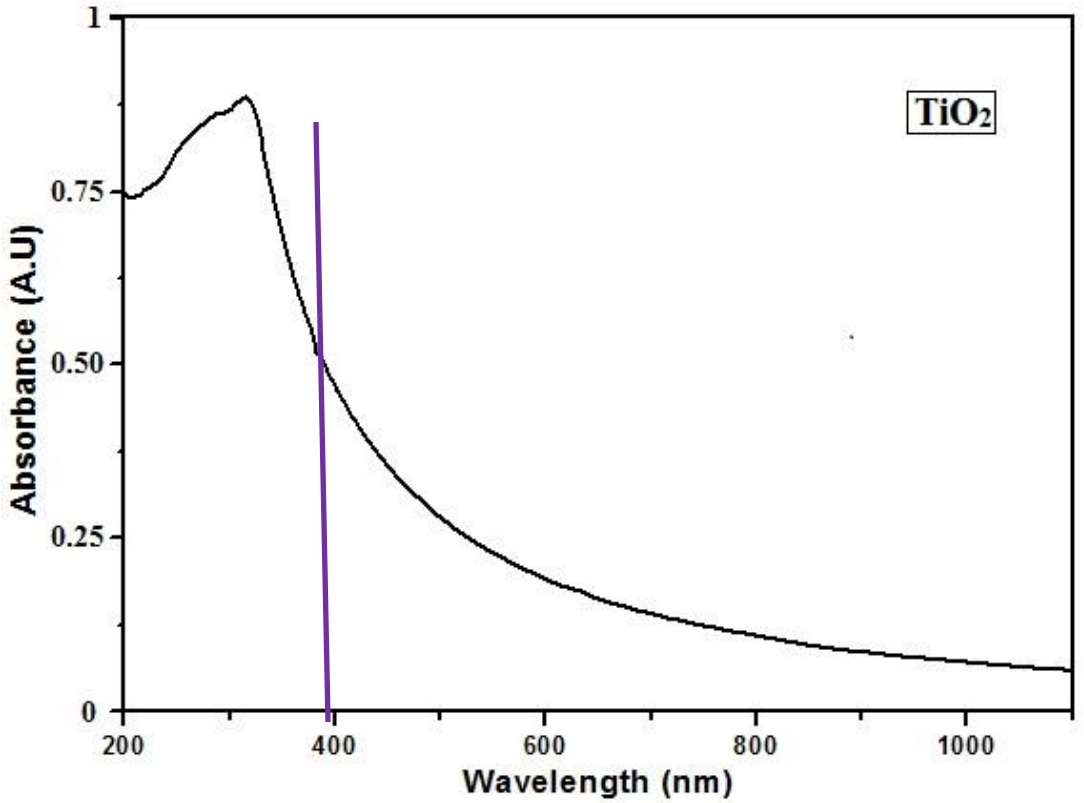
White - TiO2

- TiO2 absorbs wavelengths in the UV-C, UV-B & low UV-A
- High UV-A wavelength improves penetration through white pigment
- High irradiance (more than Gallium) significantly improves cure

✓ Higher opacity single pass? No problem

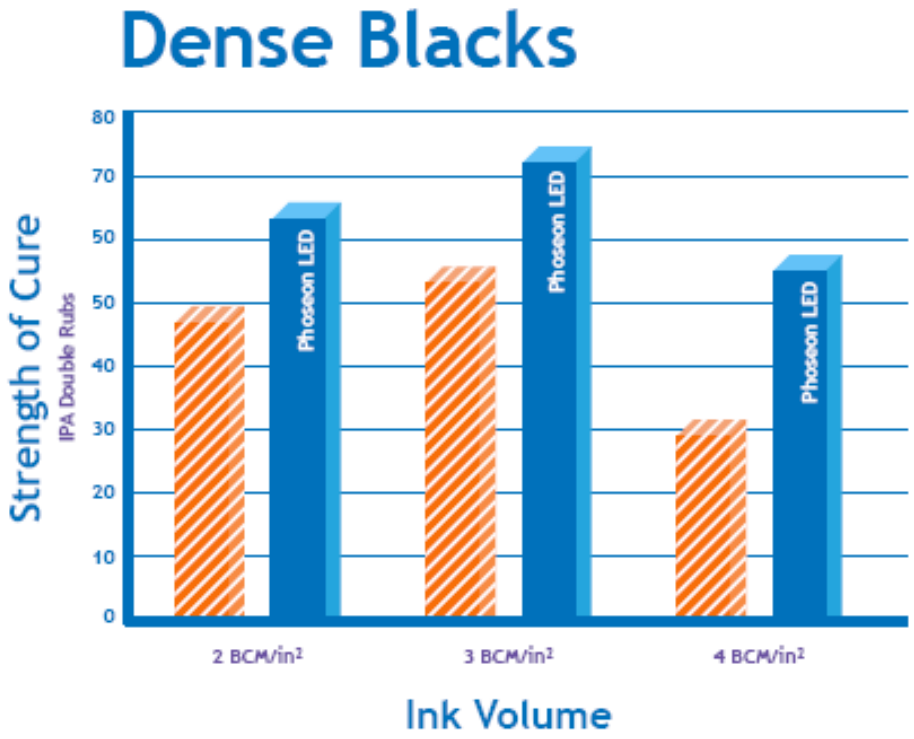
✓ Brighter Fluorescents and truer Metallics





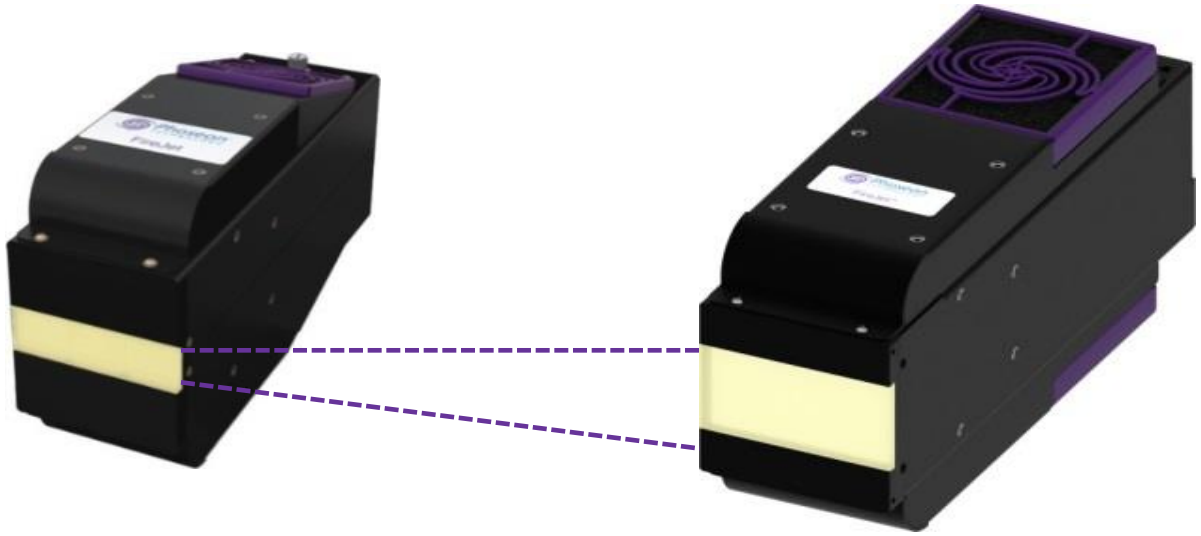
Black Ink Study – On Press Trial

- Lower peak irradiance: (12W/cm2 vs 16W/cm2)
- 40mm emitting window vs 20mm
- Same total energy density (dose)
- *Wider window = faster cure of black*
- **Speed increase of 25%**



Got PI Problems?

- Greater Energy Density (dose) will allow you to reduce PI %
- Wider emitting window (40mm vs 20mm) is a more effective way to increase Energy Density (dose) vs higher peak irradiance
- PI supply constraints expected to continue



Electrical Input vs Energy Density

Product	Emitting Window L x W (mm)	Irradiance (Watts/cm²)	DC Supply (Watts)	Nominal Power (Watts/in)	Energy Density (Joules/cm²)
A	80 x 10	8	145	45	0.56
B	75 x 20	8	670	225	1.10
C	75 x 20	8	960	325	1.10
D	75 x 40	8	1400	475	2.40

*For purposes of comparison, all four air-cooled products have flat glass emitting windows and are 395 nm.
**Irradiance for UV LED curing systems is specified at the emitting window. B and D emit up to 12 Watts/cm². C emits up to 16 Watts/cm².
***Measured at 20 fpm using an EIT L395 radiometer. Top of radiometer was 5 mm from emitting window.

A

B

C

D

Aqueous UV

- Why is this such a Hot Topic?
  - Remove monomer and replace with water
  - Formulas are ~40% solids
  - Low viscosity for application, high viscosity curable “leftover”
  - LESS EXPENSIVE

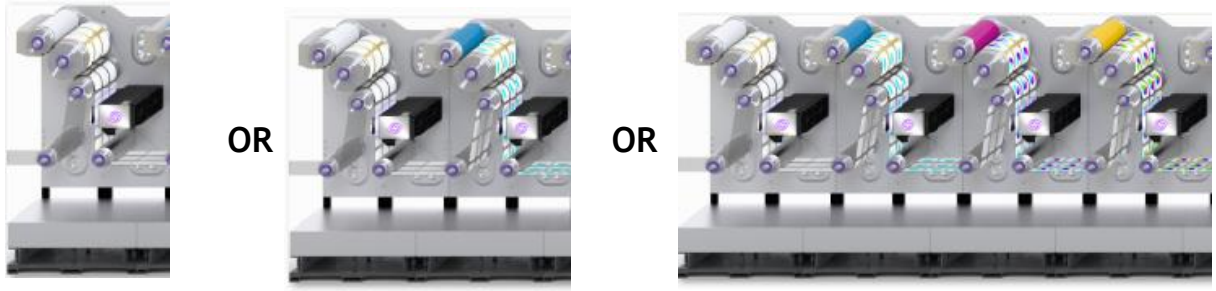
- **How high UV-A can benefit aqueous UV:**
  - Improved surface cure
    - Higher viscosity “leftover” will help reduce O2 inhibition
  - Heat from thermal step improves conversion
  - Compact lamps allow for close proximity to IR unit
  - IR LED? Possibly…

Start with ONE or TWO

- UV LED is not an “all or nothing” technology

- Equipment is extremely compact, often mounted with limited shielding
- Power requirements/supplies are compact
  - Standard 110V or 220V outlets

- Systems are easily moved around factory
  - Movable bracket
  - Slide lamps in/out
  - Conveyor on wheels
  - Scalable design



Compact, movable, easy access to lamps, scalable

If you believe LED is the future, the sooner you immerse yourself the better off you will be when its time to fully invest

Today, High UV-A Can:

Increase Throughput & Yield
15% - 20%

- Faster press speeds
- Better through cure & adhesion
- Superior curing on **black/white** inks
- Brighter fluorescents, truer metallics
- More uptime = More throughput

Be Designed to Fit your Application

- UV LED is versatile to meet your application
- Customizable configuration
- On-site installation and Engineering support across globe

Lower Operational Costs
20% – 50%

- Reduced infrastructure
- Instant On/Off
- Elimination of lamp related consumables
- Over 50% in energy savings
- Improves safety and environmental
- Easy maintenance

The greatest delivery of energy density on the market

Convert to a Solid-State Technology

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Advanced Capabilities

Only desired energy
Instant on/off
Stable and precise

Operating Economics

Energy efficient
Low temperatures
Long lifetime

Environmental Advantages

Mercury free
No waste stream
Safer workplace

Phoseon LED technology platforms provide
un-matched process stability, performance & control

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