

MOTIVATION

Thin and flexible forms for LED panels can help reduce the intake of raw material, lower manufacturing costs, provide new lighting design opportunities and accelerate global transition to SSL technology.

PROJECT OBJECTIVES

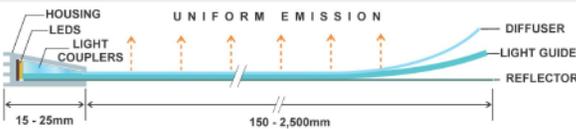
- Develop and demonstrate wide-area flexible LED panel based on inorganic LEDs.
- Achieve ultra-thin form factor with >100 lm/W luminaire efficacy and uniform surface emission using commercially available high-brightness LEDs and thin plastic substrates.
- Scale the technology to the troffer-size lighting fixtures and demonstrate low-cost mass producibility.

TECHNICAL APPROACH

CoreGLO™ is a new type of wide-area LED lighting panel which builds upon the design principles of edge lighting using thin, flexible substrates.

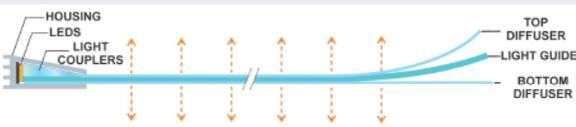
Key innovations in CoreGLO include novel LED coupling into a film-thickness material and micro-printed light guides for uniform light distribution using minimal use of raw materials.

Design A: one-sided emission



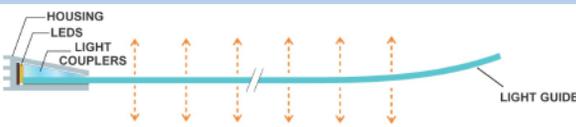
- Maximum brightness and uniformity

Design B: two-sided emission



- Best for direct/indirect lighting
- Controlled upward/downward distribution (e.g., 50/50, 60/40, etc.)

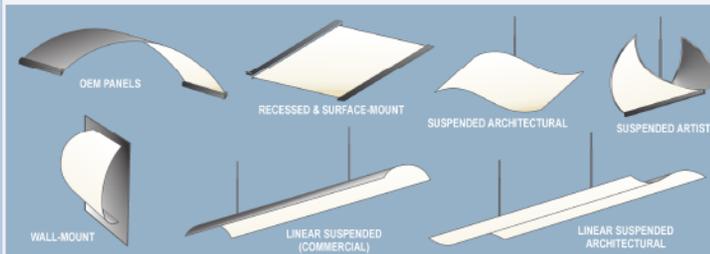
Design C: transparent



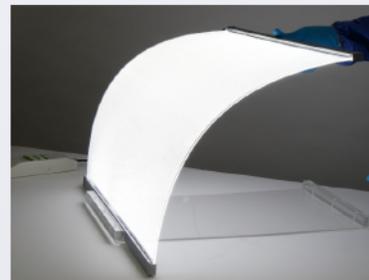
- View-through appearance
- Two-sided output w ~50/50 emission distribution

BENEFITS

- Employs latest-generation inorganic LEDs for maximizing the efficacy and light quality.
- Lower cost (\$/lm and \$/m²) than other types of wide-area luminaires.
- 2-5 times lower weight and intake of raw materials than traditional light fixtures.
- Maximum glare control without sacrificing efficiency and light output.
- Highly customizable: size/shape, appearance, beam directionality, transparency.
- New luminaire design opportunities: curved shapes, surface/interior integration, decorative patterns. Scales in size without increasing in thickness.



BRIGHTNESS & FLEXIBILITY TESTS



- Surface brightness uniformity: $>90\%$
- Peak surface luminance: 3,000-20,000 cd/m² (customizable)
- Thickness: ~1mm
- Bend radius: <50 mm
- Future goals: 0.5mm thickness, <30 mm radius, foldability



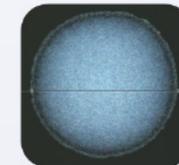
TECHNOLOGY SCALE-UP & PRODUCTIZING

- Pilot manufacturing of key CoreGLO components established
- Pre-commercial prototype of 2'x2' flexible lighting panel (Phase II goal)
- Further system-level optimization and technology scale-up in progress
- Pending product certifications
- ~20 issued U.S. patents
- Licensing options commercially available

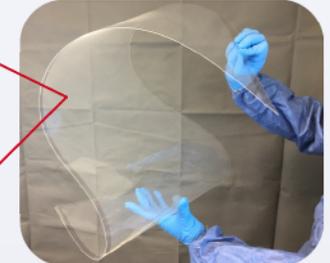


MICRO-PRINTED FLEXIBLE LIGHT GUIDES

- Now commercially available from Lucent Optics as OEM component
- End-product customization: sizes up to 2ft x 4ft; thickness 0.1mm to 10mm, transparency, frameless design, Lambertian or directional emission

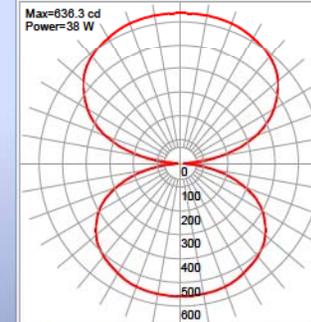


Micro-patterning using UV-cure nano-inks



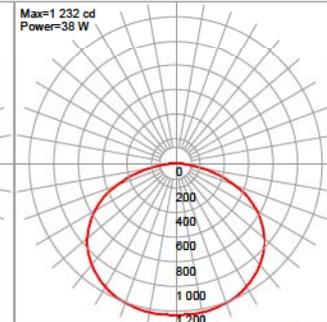
ELECTRICAL AND OPTICAL TESTS (2x2 ft PANEL)

Tests performed by an NVLAP-accredited lab. Equipment used: Type C Goniophotometer; 2M Integrating Sphere; SPR-3000 Spectroradiometer



Two-sided emission (transparent)

- 120 lm/W luminaire-level efficacy
- $<10\%$ brightness variance
- ~4,500 lumens total output



One-sided emission (opaque)

- Near-Lambertian emission pattern
- ~ 55/45% light distribution in a transparent configuration

CONCLUSIONS

- CoreGLO™ is emerging as a new technology platform for making thin and flexible LED lighting panels of various sizes and shapes at a very low cost.
- Flexible sheet-forms and new design options can be readily achieved using conventional inorganic LED technology.
- Luminaire-level efficacies >150 lm/W could be attainable for flexible wide-area panels with additional optimization.

Acknowledgments: Funding for this work is provided by the U.S. Department of Energy through SBIR Phase II Agreement No. DE-SC0015838.

Contact: Sergey Vasylyev; 916-226-1763; svasylyev@lucentoptics.com

Web: www.lucentoptics.com