RARE EARTH AND CRITICAL MATERIALS DECEMBER 6, 2010 IN ARLINGTON, VA

Breakout Sessions:

Phosphors

www.arpa-e.energy.gov

PHOSPHORS: BACKGROUND

- Terbium, Erbium, Yttrium and Europium are used as red, green, and blue phosphors for white lighting.
- New phosphors are used to downshift UV or blue emission from LEDs to form color corrected white LEDs.
- Proposed strategies include:
  - Recycling,
  - Rare-earth free phosphors,
  - Alternative mechanisms for generation of high color rendering index white emission for high efficiency general illumination, and
  - Harnessing surface plasmon effects.

PHOSPHORS: QUESTIONS

- For LED or OLED sources of white light, are there high-efficiency optical transitions in non-rare-earth materials, including size and shape modifications?
- Can new phosphors be developed which only use rare earths materials in dopant quantities (less than 0.1%)?
- For downshifted LED or OLED emitters, what are the technology gaps for achieving efficient, high color rendering index white emission?
- What are the technology gaps to maintain consistent color and intensity for cost effective, multiple wavelength LEDs?

PHOSPHORS: METRICS

- Initial Targets:
  - Warm White for General Illumination

    (2020 SSL targets adding 'no rare earth content')

    3300K Color Temperature

    > 200 lm/W Luminous Efficacy

    >90 color rendering index

    $1.1 /k-lm

    > 50k hrs

    No rare earth content in phosphors

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SUMMARY

- No rare earth content is a dramatic goal
  - Challenging on cost
  - Challenges in getting to performance in a 3 year timeframe
- Many options exist to reduce doping amounts required
- Metrics could be adjusted as
  - lm / RE oz.
  - $ / lm
- Hybrid technologies (QDs, LEDs, Phosphors, OLEDs)

QUESTIONS