Enhancing Light-Based Tissue Diagnostics by Dimpled Waveguide

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Inventors: Leon McCaughan, Thomas Kuech, Christopher Zenner, Cedric Meyers

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing edge-illuminated flexible films or panels for efficient distribution of light from solid-state sources.

Overview

Compact solid-state LED/LD (light-emitting diode) light sources are by their nature near-point sources. Applications that take advantage of these highly efficient, spectrally engineered light sources often require that the light radiate from a two-dimensional surface in a spatially modulated manner. Often it is desirable that these displays be able to redirect a multiplicity of colors, as with phosphor-coated AlGaN LEDs.

Currently, the ability to provide a two-dimensional distribution of multiwavelength light for clinical spectroscopic probes is being pursued actively. In addition to clinical and chemo-physical advancements, a new light distribution method could transform residential and commercial interior illumination, signage and display technology.

The Invention

UW–Madison researchers have developed a method of controllably and efficiently distributing the intense light available from solid-state light sources (LEDs, laser diodes, "white-light" GaN diodes, superluminescent light diodes) using a planar plate or waveguide film containing a two-dimensional array of conical indentations to distribute and/or concentrate near-point sources of light distributed at the periphery of the array.

The plate, or waveguide, is made of thin glass or other optically transparent material. Impressed into this layer are inverted cone-shaped indentations that are filled or coated by highly reflective silver. When photons from one or more light diodes strike the more numerous cones (the ratio of light sources to dimples can exceed 1:10), the light deflects laterally and radiates in proportion to the density and distribution of the conical indentations. Distributions can range from uniform to highly pixelated spots of high intensity light.

For clinical spectroscopic probes, an array of inverted reflective cones buried in a transparent planar waveguide deflects LED light from the periphery of the guide, focusing it through an array of apertures and onto the tissue to be diagnosed. The light reflected from the tissue bears a signature characteristic of either healthy or cancerous (breast) tissue. This reflected light is detected by an array of annular photodetectors, each surrounding one of the exit apertures.

Applications

- Illuminated signage
- Residential and commercial illumination
- Artworks
- Clinical applications including monitoring of tissue oxygenation and blood loss, precancer and cancer detection, intra-operative tumor margin assessment and evaluation of tumor response to cancer therapy

Key Benefits

- Permits use of remote, high efficiency, light sources
- In signage applications, greatly reduces the number of active light sources
- In clinical applications, eliminates bulky spectroscopic light sources
- When combined with annular photodetectors, can produce a low profile, flexible source/detector spectroscopic probe

Additional Information

For More Information About the Inventors

- Thomas Kuech

Related Technologies

- WARF reference number P09149US describes a miniaturized fiber optic probe for light-based diagnosis of cancerous tissue conditions.

Tech Fields

- Medical Devices : Diagnostics & monitoring tools
- Medical Imaging : Other diagnostic imaging

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846