National Aeronautics and
Space Administration

technology solution

Optics

Patterned Carbon Nanotube Arrays For Display Purposes

Method and system for providing a dynamically reconfigurable display having nanometer-scale resolution

Multi-colored electronic displays that are dynamically reconfigurable require substantial electrical power and are limited in the amount of fine detail provided, by the physical size of the light sources. For example, where phosphor elements are used, as in a television screen or computer monitor, the pixel size is generally no smaller than about 0.1mm. This limits the resolution available, where much finer work is desired. This carbon nanotube (CNT) technology provides a method and system for a dynamically reconfigurable display having nanometer-scale resolution, using a patterned array of multi-wall carbon nanotube (MWCNT) clusters. A diode, phosphor or other light source on each MWCNT cluster is independently activated, and different color light sources (e.g., red, green, blue, grey scale, infrared) can be mixed if desired. Resolution is estimated to be 40-100 nm, and reconfiguration time for each MWCNT cluster is no greater than one microsecond.

BENEFITS

- Multi-color display
- Individual 20-40 nm diameter pixel contribution
- Dynamically reconfigurable pattern and color rendition
- Low power consumption
- Frame rate comparable to conventional television display system
- Lighter displays

THE TECHNOLOGY

This invention provides a dynamically reconfigurable, multi-color display system using a grid of optionally patterned CNT arrays that are connected to a plurality of individually controlled voltage or current sources. A rectangular array of clustered CNTs, preferably multi-wall CNTs (MWCNTs) may be patterned on a substrate. A rectangular grid of crossed electrical control lines is provided, with each MWCNT cluster including, but not limited to, a single MWCNT being connected to two or more crossed control lines. Each MWCNT cluster includes one or more electrically activatable light source (EALS). Each individual line provides no more than about one half the electrical power required to activate an EALS: delivery of power from a single electrical line (only) will not activate the EALS, but delivery of power from at least a threshold number (two or more) of the crossed electrical lines at a single MWCNT cluster will activate the EALS. MWCNT clusters may include first, second and third isolated MWCNTs, each with an EALS that provides a different color when fully activated, and each of the first, second and third MWCNTs is connected to a different pair of crossed electrical lines. The different crossed pair of lines can be activated independently to activate the corresponding EALS, analogous to activation of different color phosphor dots associated with a monitor screen. Alternatively, the EALS can be chosen and configured to provide a spectrum of grey-scale light sources.

One of the applications of the technology is in the field of aviation/avionics

APPLICATIONS

The technology has several potential applications:

- Aviation/avionics
- Very HD display to simulate windows in aircraft, cruise ships, mental health facilities, hospitals, and living spaces
- Lightweight display for mobile devices
- Virtual reality and games

PUBLICATIONS

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More Information

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