Methods and Apparatus for Transparent Display Using Up-converting Nanoparticles  
Technology #16097

Applications

Three-dimensional transparent displays in medicine, engineering, scientific research and development, oil and gas extraction, and entertainment.

Problem Addressed

A number of transparent display technologies exist, but none have gained widespread usage. By eliminating the backlight of a liquid crystal display (LCD), the transparency is increased, but only up to a transmittance of about 15%. An organic light-emitting diode (OLED) can also be made transparent, but OLED production remains costly and OLED transmittance is also limited (typically less than 40%). Electroluminescent displays have also been made transparent; however, they have been limited to single colors. Recently, fluorescent films have been combined with ultraviolet (UV) lights to make multi-colored displays that are transparent; yet, intense UV sources are required due to the small emission cross sections of the fluorescent particles.

There has also been progress in 3D transparent displays, but such technologies have remained either in the lab or in specialized facilities. Technologies based on revolving 2D displays suffer from image flickering. Stacking several 2D displays yields a quasi-3D display with a limited viewing angle that cannot provide true 3D image depth. At least one prototype of a volumetric 3D laser display has also been demonstrated, but it was a miniature device, and its production is very difficult to scale. To date, none of these technologies has yielded a 3D display that is practical enough for consumer use.

Technology

This technology consists of transparent color displays with nanoparticles made with nonlinear materials and is designed to exhibit optical resonances. These nanoparticles are embedded in a transparent substrate, such as a flexible piece of clear plastic or acrylic. Illuminating the nanoparticles with invisible light (e.g., infrared or ultraviolet light) causes them to emit visible light in a desired pattern.

Advantages

- Display true volumetric 3D images without special eyeglasses
- Scalable to large display sizes

Categories For This Invention:

Photonics  
Data Communications

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Displays
Life Sciences
Imaging
Instrumentation
Other (Instrumentation)

**Intellectual Property:**

Methods and apparatus for transparent display using up-converting nanoparticles
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**Image Gallery:**

![Image of a circuit diagram]