(SD2016-323) Broadband Absorbers Via Hyperbolic Metamaterial Particles

Tech ID: 27398 / UC Case 2016-323-0

BACKGROUND

Broadband absorbers are essential components of many light detection, energy harvesting and camouflage schemes. Materials that “perfectly” absorb light already exist, but they are bulky and can break when bent. They also cannot be controlled to absorb only a selected range of wavelengths, which is a disadvantage for certain applications. In addition, transferring planar materials to flexible, thin or low-cost substrates poses a significant challenge.

TECHNOLOGY DESCRIPTION

Engineers at UC San Diego have patented a new class of particle absorbers called transferable hyperbolic metamaterial particles (THMMP) that display selective, omnidirectional, tunable, broadband absorption when closely packed. They are thin, flexible and tunable. This near-perfect broadband absorbing technology, absorbs more than 87 percent of near-infrared light (1,200 to 2,200 nanometer wavelengths). The material is capable of absorbing light from every angle and it also may be tuned to distinct parts of the electromagnetic spectrum.

APPLICATIONS

Numerous applications are possible, for this thin, flexible, light-absorbing material (e.g. transparent window coatings that keep buildings cool, lightweight shields that block thermal detection).

ADVANTAGES

This technology can be scaled up to make large surface area devices, such as broadband absorbers for large window.

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OTHER INFORMATION

KEYWORDS
Hyperbolic metamaterials, perfect absorber, nanoparticle, nanowire, particle transfer, particle transfer, nanowire, nanoparticle, Hyperbolic metamaterials

CATEGORIZED AS
- Materials & Chemicals
  - Nanomaterials
  - Thin Films

RELATED CASES
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Sirbuly et al.

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(54) **BROADBAND ABSORBERS VIA NANOSTRUCTURES**

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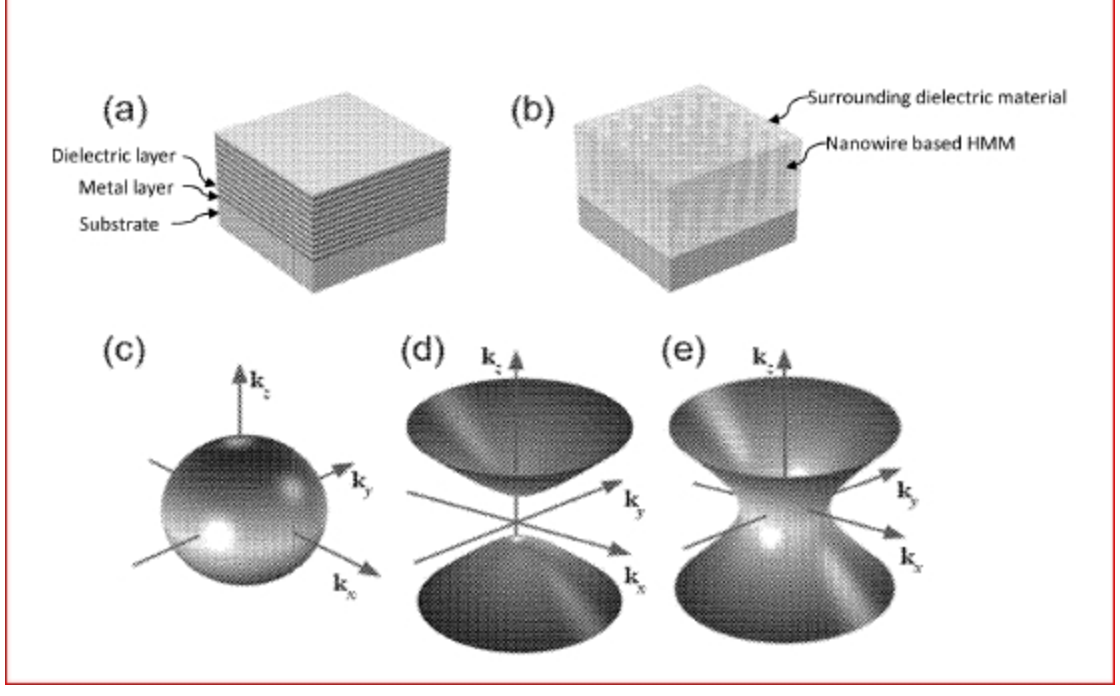
(52) **U.S. Cl.**

CPC ***G02B 1/002*** (2013.01); ***G02B 5/003*** (2013.01); ***C23C 16/02*** (2013.01); *G02B 2207/101* (2013.01); ***C23C 16/56*** (2013.01); ***G03F 7/0015*** (2013.01); ***C23C 16/45525*** (2013.01)

(57) **ABSTRACT**

The document discloses transferrable hyperbolic metamaterial particles (THMMP) that display broadband, selective, omnidirectional absorption and can be transferred to secondary substrates, allowing enhanced flexibility and selective transmission. A device having metamaterial nanostructures includes a substrate and metamaterial nanostructures engaged to the substrate to form an optical layer to interact with light incident to the optical layer to exhibit optical reflection or absorption or transmission that is substantially uniform over a spectral range of different optical wavelengths associated with materials and structural features of the metamaterial nanostructures, each metamaterial nanostructure including different material layers that are interleaved to form a multi-layer nanostructure.



STATE OF DEVELOPMENT

Broadband and selective absorption has been experimentally demonstrated for the hyperbolic tubes.

INTELLECTUAL PROPERTY INFO

U.S. Patent Application No. 16/479,892

BROADBAND ABSORBERS VIA NANOSTRUCTURES

has allowed claims and will be granted in the fall of 2022.

1st claim:

A device having metamaterial nanostructures, comprising:

a substrate; and

metamaterial nanostructures engaged to the substrate to form an optical layer to interact with light incident to the optical layer to exhibit optical reflection or absorption or transmission that is substantially uniform over a spectral range of different optical wavelengths associated with materials and structural features of the metamaterial nanostructures, each metamaterial nanostructure including different material layers that are

interleaved to form a multi-layer nanostructure,

wherein the different material layers in at least one of the metamaterial nanostructures are concentric layers around a center to form a sphere.

RELATED MATERIALS

- 'Near-perfect' broadband absorber invented. UCSD News Release. - 02/07/2017
- Riley CT, Smalley JS, Brodie JR, Fainman Y, Sirbuly DJ, Liu Z. Near-perfect broadband absorption from hyperbolic metamaterial nanoparticles. Proc Natl Acad Sci U S A. 2017 Jan 24. pii: 201613081. doi: 10.1073/pnas.1613081114 - 01/24/2017

PATENT STATUS

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Additional Patent Pending

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