APPLIED PHYSICS LETTERS **96**, 019902 (2010)

Erratum: "System investigation of a rolled-up metamaterial optical hyperlens structure" [Appl. Phys. Lett. 95, 083104 (2009)]

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(Received 27 November 2009; accepted 2 December 2009; published online 5 January 2010)

[doi:10.1063/1.3276552]

Typing errors as well as a calculation error were made in the original publication of this letter. Here we correct the equations, resulting calculations, and figures of the original letter. The effective media theory equations for calculating the permittivity were both written incorrectly in the letter, and an incorrect version of the effective radial permittivity was used for our calculations. This makes the hyperbolic range of Fig. 2(a), and the dispersion relation graphs in Figs. 1(d) and 2(b), incorrect. The correct equations are as follows: $\varepsilon_r=[(c_m+c_d)\varepsilon_m\varepsilon_d]/(c_d\varepsilon_m+c_m\varepsilon_d)$ and $\varepsilon_\theta=(c_m\varepsilon_m+c_d\varepsilon_d)/(c_m+c_d)$. The revised Fig. 1 and 2 calculated with the correct permittivity formulas are shown below.

Using rolled-up bilayers for creating the hyperlens and the hyperlens immersion technique presented in the original letter still stand valid despite these errors. Using the correct equation for the radial permittivity results in a lower spectral range where the dispersion relation is hyperbolic for the material systems we chose to look at. However, for a higher ratio of oxide:metal, the dispersion relation becomes elliptical, as shown in the revised Figs. 1(d) and 2. This elliptical dispersion, as mentioned in the original letter, allows for the transmission of high order spatial information into the far-field even though light is not mediated through an unbound dispersion relation. Despite the ability to resolve subwavelength objects with an elliptical dispersion relation, the opti-

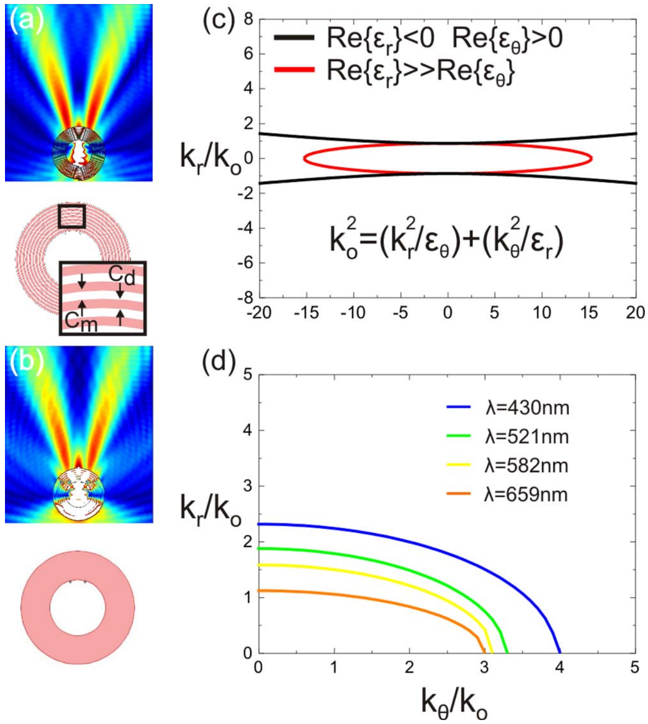

FIG. 1. (Color online) A diagram showing both a hyperlens using a realizable rolled-up TiO_2/Ag structure (a) and one using the effective permittivity theory (b). Objects being imaged are $\lambda/30$, separated by a distance of $\lambda/2$. (c) Using material combinations which result in anisotropy with characteristics of $\mathrm{Re}\{\varepsilon_r\}\gg\mathrm{Re}\{\varepsilon_\theta\}$, elliptical dispersion, or $\mathrm{Re}\{\varepsilon_r\}<0$ and $\mathrm{Re}\{\varepsilon_\theta\}>0$, hyperbolic dispersion, allow for the transmission of subwavelength information. (d) The elliptical dispersion relation curves for a TiO_2/Ag 5:1 ratio structure are plotted, showing a lens which is capable of transmitting subwavelength information over the entire visible spectrum.

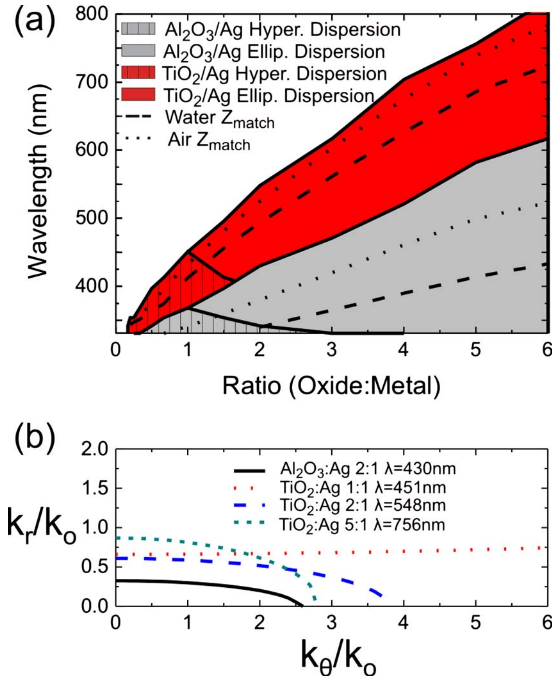

FIG. 2. (Color online) The anisotropic range of a hyperlens with different ratios of oxide to metal is presented (Al_2O_3/Ag plot overlaid on TiO_2/Ag plot). (a) The tunable hyperbolic dispersion range (solid color with bars) is defined to be where $\mathrm{Re}\{\varepsilon_r\}<0$ and $\mathrm{Re}\{\varepsilon_\theta\}>0$, given the criteria for the hyperlens effect and elliptical dispersion range (solid color), which is defined as $\mathrm{Re}\{\varepsilon_r\}\gg\mathrm{Re}\{\varepsilon_\theta\}$. The dotted lines are the wavelengths required for impedance matching (Z_{match}) the given metamaterial lens with air, whereas the dashed are those required for matching with water, which result in a high transmission into the far field. (b) The dispersion relation for different material makeups is shown at different wavelengths in the visible spectrum. This illustrates the fact that the dispersion relation, whether hyperbolic or elliptical, is relatively flat, which results in high resolution of high order spatial information.

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0003-6951/2010/96(1)/019902/2/$30.00

mal relation is hyperbolic for the fact that the relation becomes unbounded Fig. 2(b).

We originally stated that as the metal filling ratio is decreased, the dispersion relation approaches flatness allowing for objects of arbitrary size to be transmitted into the far-field. This statement is incorrect, as the filling ratio of metal is decreased the dispersion relation becomes elliptical, which ultimately limits the smallest resolvable object. In the original conclusion we stated, "This graph shows that hyperlensing is obtainable over the entire visible range of light" which is incorrect because this statement was referring to a definition of hyperlensing being the region in which a hyperbolic dispersion relation exists for the material. One can see from the revised Fig. 2(a) that this in fact does not happen over the entire visible range. However, subwavelength information is transmittable over the entire visible range, but via elliptical dispersion for longer wavelengths rather than a hyperbolic relation at shorter wavelengths.

The authors would like to thank Suwit Kiravittaya for critical reading of our erratum.