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Biomimetic artificial Si compound eye surface structures with broadband and wide-angle antireflective properties for Si-based optoelectronic applications

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Supplementary Information

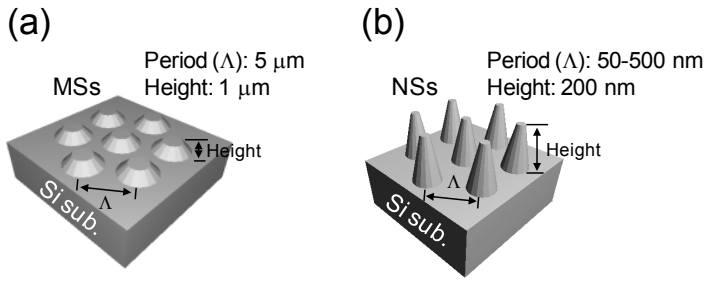

Fig. S1 3D simulation models used in these RCWA calculations for the (a) MSs and (b) NSs on flat Si substrates.

Figure S1 shows the three-dimensional (3D) simulation models used in these RCWA calculations for the (a) MSs and (b) NSs on flat Si substrates. In these calculations, for both the MSs and NSs, the simulation models were roughly represented by a periodic geometry with a 2D hexagonal symmetry pattern, which is a unit cell structure, in the Cartesian coordinate system by a scalar-valued function of three variables, $f(x, y, z)$, for simplicity. For each structure, the shapes can be defined by the following equations:

$$r = R + (H - z)^{1/O_T} \quad \text{and} \quad x^2 + y^2 = r^2 \qquad (0 \le z \le H), \tag{1}$$

where the r is the radius of circle in x-y plane, H, R, and O_T are the height, the bottom radius, and the order of taper of each structure, respectively. Further details can be found in our previous work.[1] As shown in Fig. S1(a), for the MSs, the average period and height were set to 5 and 1 μm, respectively. For the NSs in Fig. S1(b), on the other hand, the average height was kept at 200 nm and the average period was changed from 50 to 500 nm. For both the structures, the order of taper and thickness of Si substrate were 1 and 520 μm, respectively. The refractive index and extinction coefficient of Si used in these calculations were referred from the *SOPRA N&K* Database.[2] For the theoretical optical analysis, the RCWA calculations were carried out using a commercial software (*DiffractMOD* 3.1, Rsoft Design Group).[3]

Supplementary Information References

1. Y. H. Ko and J. S. Yu, *Opt. Express*, 2011, **19**, 297.

2. SOPRA. http://www.sopra-sa.com and http://refractiveindex .info, accessed 1 Jan. 2013.

3. DiffractMOD, RSoft Design Group. http://www.rsoftdesign.com, accessed Jan. 2013.