Special Feature
Applied Nanoscale Morphology: Form-originated Novel Properties

Overview

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Special "forms" sometimes give anomalous properties to pure materials beyond their nature. A typical example is the intense visible photoluminescence (PL) of porous Si (PS) reported in 1990. During the intensive search for the origin of the PL, the 2-dimensional (2-D) atomic layer of Si in $CaSi_2$ was found to give PL similar to PS when each of them was terminated above and below by H atoms by HCl processing. Although those mono-atomic layers were electronically isolated with each other, they still retained the original stacked structure associated with $CaSi_2$. The authors of the first article in the present issue detached these mono-layers into nanosheets (SiNSs) for the first time. The resultant SiNSs are potential building blocks for novel Si-based functional nano-materials. More recently, this SiNS is also spotlighted as a counterpart of another 2-D Si: silicene which is inheriting the hot researches of graphene. In the second article, arrays of sub-wavelength holes in an Al thin film made an optical color filter beyond the pure metallic property. In the third articles, self-assembly of colloidal silica spheres in a simple spray coating process gave artificial iridescence practically applicable to pigments. Giving such special "forms" to materials leads to enhanced interface area and interactions across it. The forth article analytically revealed oxidation of organic substances adjacent to the transparent conducting oxide electrode as an origin of degradation in organic light emitting diodes. This also suggests a remaining big challenge in organic photovoltaic devices, since the special "form" called as "bulk hetero junctions" is essential to compensate for short exciton transport distances, resulting in an enormous interface area.