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Silicon Light Source for Optical Computing and Communications
RYAN LU, A.D. RAMIREZ, SPAWAR Systems Center, S.A. CAMPBELL, U. KORTSHAGEN, R. LIGMAN, R. LIPTAK, X. PI, University of Minnesota — Silicon is the choice of material in modern microelectronics but, as an indirect-bandgap semiconductor, it is not an efficient light emitter in its bulk form, as a laser or a light-emitting diode (LED). A silicon laser will be advantageous for monolithic integration with current CMOS technology in order to eliminate the interconnect bottleneck. Silicon LEDs, on the other hand, may revolutionize solid-state lighting and displays because of the low cost and environmental friendliness of silicon. One of the most challenging problems of silicon-based lighting and displays is the lack of a reliable and efficient full visible spectrum emission. Here we show an all gas-phase high-production-yield synthesis of silicon nanocrystals that emit light from red to blue despite oxidation in air. The quantum yields of these oxidized silicon nanocrystals can be as high as 65 percent. Furthermore, this approach is compatible with microelectronic manufacturing. The present findings advance the development of photonic applications especially silicon-based lighting and display technology.

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