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Abstract

Aluminum-catalyzed silicon nanopyramids grown using low-pressure chemical vapor deposition (LPCVD) are presented as an approach to silicon surface texturing. The nanopyramids are grown by vapor-liquid-solid growth using aluminum thin films on silicon. Silicon nanowires with hexagonal cross-sections are formed at a growth temperature of 650°C; as the temperature is increased to 700°C, the wires become pyramid-shaped with triangular cross-sections. The silicon nanopyramids are single-crystal and grow in the <111> direction with (112) facets, as confirmed by transmission electron microscopy. Pyramid tapering increases with increasing growth temperatures and the pyramid arrays grown at 700°C show reflectivities between 4 and 6% between 400nm and 800nm and appear black to the eye. Based on these results, aluminum-catalyzed nanopyramids present themselves as a plausible alternative to etch-based silicon surface textures.

Keywords: A1. Nanostructures, A3. Chemical vapor deposition processes, B1. Nanostructures, B2. Semiconducting silicon, B3. Solar Cells.