Lewis Acid Induced Functionalization of Photoluminescent 2D Silicon Nanosheets for the Fabrication of Functional Hybrid Films

Various Lewis acids are found to efficiently catalyze hydrosilylation reactions of hydride-terminated 2D silicon nanosheets at room temperature. The hydride-terminated nanosheets can be functionalized with a variety of unsaturated functional substrates and still possess their unique characteristic (opto)electronic properties (e.g., photoluminescence). This is demonstrated by successfully implementing the readily functionalized materials into new silicon/semiconducting polymer-based field-effect transistors (FETs). Surface modification of the freestanding silicon nanosheets opens new possibilities to form highly homogeneous blends with the already broadly used conventional polymers poly(3-hexylthiophene-2,5-diyil). The consequential combination of the different properties of the materials enables the enhancement of the sensitivity of the solution-gated FETs and increases the transconductance of the operating device.