Nanostructured Silicon: Quo vadis?
From green hydrogen to nanomedicine

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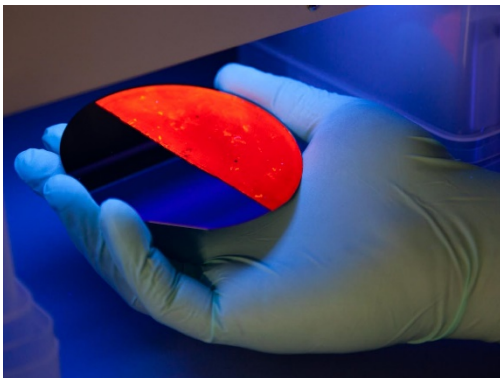

The future of modern society is tied to the availability of sustainable energy resources and effective diseases diagnostics and therapy. However, among various sources of energy, sunlight is the most abundant and cleanest natural energy resource. It is presumed that the grid parity of solar cells can be reached by using nanostructured semiconductors or a new solar cell architecture that is most-likely based on nanotechnology. Over the last years, top-down and bottom-up silicon nanowires have been favored in my group at Leibniz IPHT/Germany as a promising highly effective optoelectronic material due to a number of unique physical-chemical properties. Hydrogen is regarded to be one of the most promising green energy sources in the Industry 4.0. One promising approach to produce hydrogen is a photocatalytic water splitting. The high porosity leads to an increased active surface area and also to an enlarged optical band gap in nanostructured silicon. Cancer diagnostic and therapy challenge the scientific community to design research addressing the urgency of ending cancer. These novel nanostructures are based on insights gained during the last years of research in my group and are expected to lead to significant progress steps, by which such material will be promoted from “promising material” to effective material for the biophotonic and biomedical applications. For all these reasons new labeling and drug delivery agents for bio-application are an important field of research with a growing potential for medical use. The groundbreaking developments in surface engineering of the silicon surface and the coupling of nanostructured silicon with functional semiconductor oxides and noble metals offer new perspectives for silicon-based technologies, which will be discussed in details in this presentation.