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Elimination of toxic gases to synthesize doped silicon nano wires and their application in electronic devices

Krishna Nama Manjunatha
De Montfort University, UK

Silicon is widely used in electronic industries in various forms including crystalline, polycrystalline and amorphous for applications in Li-ION batteries, liquid-crystal display, electronic memory and photovoltaic solar cells. Due to demand in the current era for increasing efficiency of solar cells, capacity in Li-ION batteries, data storage capability in memory devices; nanostructures of silicon have proved to be appropriate to address these demands. Additionally, there is also demand for fabrication of these devices economical and sustainability efficiency. The forementioned demands and few additional challenges such as synthesis of sustainable low temperature processes of obtaining doped and undoped silicon nanowires (SiNWs) is achieved by optimizing and/or finding alternative fabrication procedures. For the growth of SiNWs, chemical vapour deposition techniques are commonly used and doping of SiNWs are achieved either by diffusion processes, dissociation and injection of dopants from gaseous precursors (diborane and phosphine) during the nano wire growth. However, the growth temperature in this technique exceeds 600ºC and employs toxic gases. Using a combination of plasma enhanced chemical vapour deposition (PECVD) and selective metal catalyst, have been shown to result in the growth of doped and undoped silicon nanowires ≤300ºC. Doping from appropriate metal catalysts has several advantages such as elimination of toxic gases, avoiding the complexity of counter-doping caused from the catalyst, reducing costs and simplifying the optimization process. Using this process, we are able to grow silicon structures on plastic/glass substrates and have demonstrated their use in electronic devices.

Krishna.namamanjunatha@dmu.ac.uk