Abstract #782, 223rd ECS Meeting, © 2013 The Electrochemical Society

Nanocrystalline approaches to electronic materials using subsecond thermal processing

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This talk reviews the advances that subsecond thermal processing in the millisecond-range using xenon-filled flash lamps brings to the processing of the most advanced semiconductor materials, thus enabling the fabrication of novel electronic structures and materials. It will be demonstrated how such developments can translate into important practical applications leading to a wide range of technological benefits. An important issue of our work was the formation and characterization of Si-based light electroluminescence from MOS structures with group-IV- and rare earth-containing dielectric layers. Recently we could demonstrate that germanium and silicon exhibit superconductivity at ambient pressure. Regarding photovoltaic applications, we dealt with the ion beam doping and thermal processing of PV silicon demonstrating a distinct improvement of the minority carrier diffusion length compared to RTP and furnace treatments. Whereas these examples base on solid phase processing the more sophisticated approach regards on working with the liquid phase at the surface of solid substrates. A recent example is the controlled formation of III-V nanocrystals (InAs, GaAs) in silicon after ion beam synthesis (NanoLett. **11**, 2814 (2011)). Moreover, a new approach of forming compound semiconductor nanocrystals inside a silicon nanowire will be demonstrated.