142v Continuous Flow Microreactor for Chemical Bath Deposition

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Over the years, chemical bath deposition (CBD) has been successfully used in the deposition of many compound semiconductors. Usually carried out as a batch process, CBD has received a great deal of attention due to its low temperature and low cost nature. However, a major drawback of batch CBD process is the formation of particles as well as unwanted deposition that generates waste and defects on devices. In this work, we have developed a continuous flow microreactor for CBD to overcome the drawbacks of a batch process. This novel microreactor setup makes use of a micromixer for efficient mixing of the reactant streams and helps in controlling the homogeneous reaction before the solution impinges on a substrate. Transmission electron microscopy analysis indicated an impinging flux without the formation of nanoparticles could be obtained from this reactor. Uniform and highly oriented nanocrystalline CdS semiconductor thin films were successfully deposited on oxidized silicon substrates using this microreactor setup. The surface morphology of the deposited films, characterized by atomic force microscopy (AFM), scanning electron microscopy (SEM) and 3D Dektak surface profiler, clearly indicated an improvement of film smoothness and coverage over films deposited from a batch process. Furthermore, functional thin film transistors could be fabricated from the as-deposited films without any post annealing process. This new approach could be adopted for the deposition of other compound semiconductor thin films using solution- based chemistry with improved control over processing chemistry and minimize waste production.