

Stimuli-responsive polyelectrolyte multilayer thin films for remote activated dual drug delivery

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We demonstrate a novel drug loading protocol in polyelectrolyte thin films to develop a transparent, dual drug loaded thin film platform for remotely activated drug delivery. The composite film was designed by alternate adsorption of poly(allylamine hydrochloride) (PAH) and poly(methacrylic acid) (PMA) on glass substrate followed with nanoparticle synthesis through polyol reduction method. The films showed a uniform distribution of spherical silver nanoparticles with an average diameter of 50 ± 20 nm, which could be increased to 80 ± 20 nm when the AgNO_3 concentration increased from 25 to 50 mM. The porous and supramolecular structure of polyelectrolyte multilayer film was used to immobilize ciprofloxacin hydrochloride (CH) and bovine serum albumin (BSA) in the polymeric network of the film. The film undergoes morphological changes when exposed to internal and external triggers such as pH, ionic strength, laser light and ultrasound. When exposed to these triggers, the loaded films get ruptured and releases the loaded BSA and CH. The release of CH is faster than that of BSA due to their higher diffusion rate. Circular dichroism measurements confirmed that there was no significant change in the conformation of released BSA in comparison with native BSA. Applications envisioned for such drug-loaded films include drug and vaccine delivery through transdermal route, antimicrobial or anti-inflammatory coatings on implants and drug-releasing coatings for stents.

Biography

S. Anandhakumar has completed his Ph.D. from Indian Institute of Science (IISc), Bangalore in 2011 and continued as a postdoctoral fellow for few months in IISc. Then he joined as a Assistant Professor in SRM university in March 2012. He has published 6 papers in reputed international journals and written one book chapter. He has been serving as a reviewer in many journals.

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High Performance ZnO based thin-film transistors for large area microelectronics

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The ever increasing demand for high performance electronic devices that can be fabricated onto large-area substrates employing low manufacturing cost techniques gave boost to the development of alternative types of semiconductor materials, such as organics and metal oxides, with desirable physical characteristics that are absent in their traditional inorganic counterparts. Metal oxide semiconductors, in particular, are very attractive for implementation into thin-film transistors (TFTs) mainly because of their high charge carrier mobility, high optical transparency, excellent chemical stability, mechanical stress tolerance and processing versatility. Here we demonstrate solution processed ZnO based transistors with electrical characteristics comparable to those produced by high manufacturing cost techniques. The physical properties of ZnO films have been investigated using a range of characterisation techniques. Structural studies show that crystallinity of ZnO films increases as the deposition temperature, which in turn raises the mobility of TFTs too. Mobility of $25 \text{ cm}^2/\text{Vs}$ has been achieved for undoped ZnO based TFTs, fabricated on Si/SiO₂ substrates using Al as S/D contacts. An interesting finding is the strong dependence of the electron mobility on the work function of S/D electrodes (i.e. Ca, Au, Al) and on the transistor channel length. Short channel TFTs exhibit improved performance as compared to long channel devices. This effect is attributed to grain boundary effects that tend to dominate charge transport in TFTs with $L < 40 \mu\text{m}$. Another key finding of this work is the demonstration of low operating voltage ($< 1.5\text{V}$) TFTs by combining Spray pyrolysis with a number of solution-processible self-assembled monolayer (SAM) dielectrics. The transistors fabricated on glass substrates exhibit excellent operating characteristics with minimal hysteresis and mobility as high as $7 \text{ cm}^2/\text{Vs}$. The simple spray pyrolysis approach used here expands the possibilities for development of improved multi-component oxide semiconductors and TFTs and microelectronics that can be processed onto large area substrates using this rather simple and low-cost deposition process. A remarkable aspect of our approach is the accurate control over the electronic properties of the spray pyrolysed films through tuning of the starting precursor solution stoichiometry.

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