SOLUTION PROCESSED INORGANIC SOLAR CELLS

With the abundant availability of renewable energy from the sun, one can easily obtain all the power needed for society to continue its growth. What is holding the progress from moving forward is not the capability, but rather the economics. Thin-film solar cells create one step towards the reduction of costs by utilizing less material, but they have difficulty in scalability. To assist in scalability and further reduce costs, we have turned to the development of solution processed solar cells.

In our solution-based approach, we have taken a two prong approach. In the first approach, we synthesize nanoparticles of candidate compound semiconductors and disperse them in solvents to formulate inks. In the second approach, we are developing a new chemistry based on amine-thiol mixtures to dissolve precursor compounds that could not be earlier dissolved in common solvents to prepare molecular precursor inks. These inks are then used to print micron thick films on suitable substrates and heat treated to grow large grains suitable for good optoelectronic properties. Our group is studying the dissolution mechanism for molecular precursors, mechanism for grain growth during annealing under different environments and is characterizing final devices for their optoelectronic performance. We are also using the solution chemistry to synthesize some new and promising semiconducting materials and their thin films. Some examples of the semiconducting materials being explored in our lab are: Cu(In,Ga)(S,Se)2, Cu2Zn(Sn,Ge)(S,Se)2, Cu3P(S,Se)4, Cu3As(S,Se)4, ZnSnP2, SnS etc.

In this talk, we will highlight some of the important findings of our group’s research including fabrication of Cu(In,Ga)(S,Se)2 and Cu2Zn(Sn,Ge)(S,Se)2 solar cells with power conversion efficiencies of 15% and 9.4% respectively. The excitement of this route’s science and technology along with its challenges will be presented.