Chemistry of Organic Solar Cells

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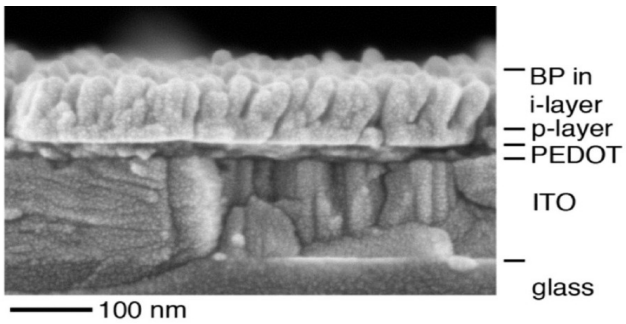
Two major problems exist in organic solar cell research: design on molecules and control of molecular organization in a nm-thick film. Organic chemists may consider that they are the experts in the first area, but a tough issue is that there is only one natural model – porphyrin, from which we can learn only a little. We must use our own imagination on molecular design rather than going through the natural repertoire of organic molecules.

The second problem was entirely new to every one in any field of science and engineering. To make the best use of the best molecule, we must completely control the hierarchical organization of several different molecules in a nm-thick film. We must also take care of the physical properties of the molecular composite including refractive index. An additional problem that organic chemists have never seriously thought about is the durability of the molecules and molecular organization under light and heat irradiation over 10 years!

There has been a slow but steady progress in the area in the past 10 years, and the best power conversion efficiency achieved in the laboratory is surpassing the best data for amorphous silicon solar cells. This lecture will address some of the chemical problems in the research on organic solar cells.



A dissection SEM image of a solar cell made of tetrabenzoporphyrin (BP) columns of 50-nm height