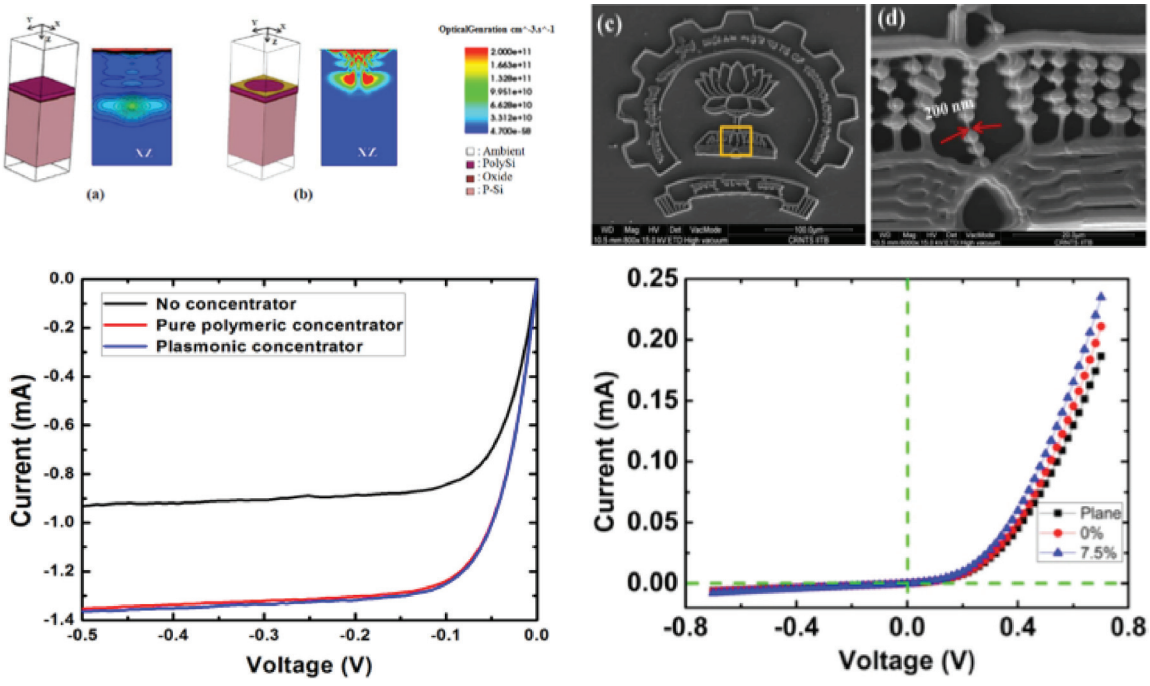
Plasmonics: The way to efficient photodevices via two-photon lithography

A photodiode is a device capable of converting light energy into electrical signal. The materials used to make these devices critically define the properties and performance of the photo-devices. Thus the materials primarily act as a detrimental factor in limiting the performance of these photo-devices. This bottleneck can be removed partially by using plasmonic structures which can be fabricated easily by two-photon lithography (TPL).

At the Nanostructures Engineering and MOdeling (NEMO) Laboratory, we have taken a leap forward by incorporating plasmonic structures fabricated using two-photon lithography to enhance the performance of the solar cells as well as photo-detectors. We have tested the performance of these plasmonic structures on different type of solar cells. The efficiency of was found to increase by at least 20% without any optimisation for coupling, by simply placing them on the devices. In a broader perspective, this innovation is expected to revolutionise the photo-devices industry fabricating solar cells, photo detectors, microscopy, etc. by enhancing the efficiency/ improving the resolution of imaging devices.



(a) Propagation of light in the active medium of a photo-detector (b) Concentration of light within the active region of the photo-detector showing increased intensity of light in the active medium (c) Fabrication capability of TPL which can be used to fabricate/write complex, continuous and even curved structures. 200µm x 200µm logo of IITB written using TPL (d) Zoomed in image to show the precision of fabrication (e) Response and enhancement in performance of a solar cell (f) ZnO based photo-detector by incorporating plasmonic nanostructures

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