

Enhancement of Light Trapping in C-Si Solar Cell for different Periodicities using Silver (Ag) as the core of Plasmonic Nanowire

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Abstract: Integrating plasmonic metal nanoparticles of gold or silver as the core of nanowire (NW) solar cells can enhance their ultimate efficiency. We propose a triangular and circular crystalline silicon plasmonic nanowire (c-Si PNW) solar cell by employing silver core inside the nanowire. By keeping the filling ratio and length of the nanowire fixed, we were able to find an Ultimate efficiency as high as 44.28% and 40.54% for circular and triangular plasmonic nanowires (PNW) respectively.

1. FIGURES

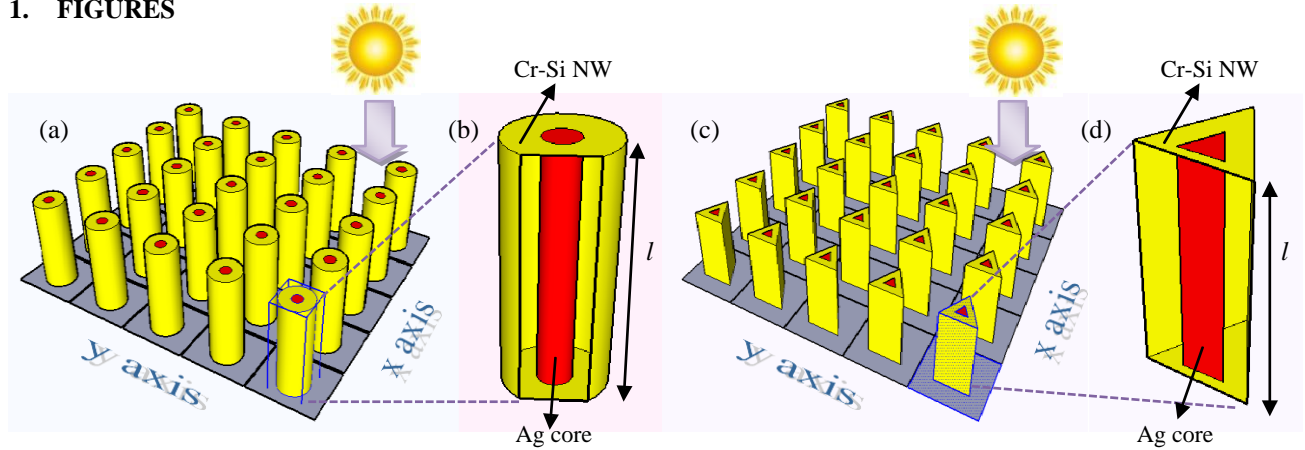


Fig 1: (a) Circular Cr-Si PNW array (b) Internal view of circular PNW with fixed length l (c) Triangular Cr-Si PNW array (d) Internal view of triangular PNW with fixed length l

2. RESULTS

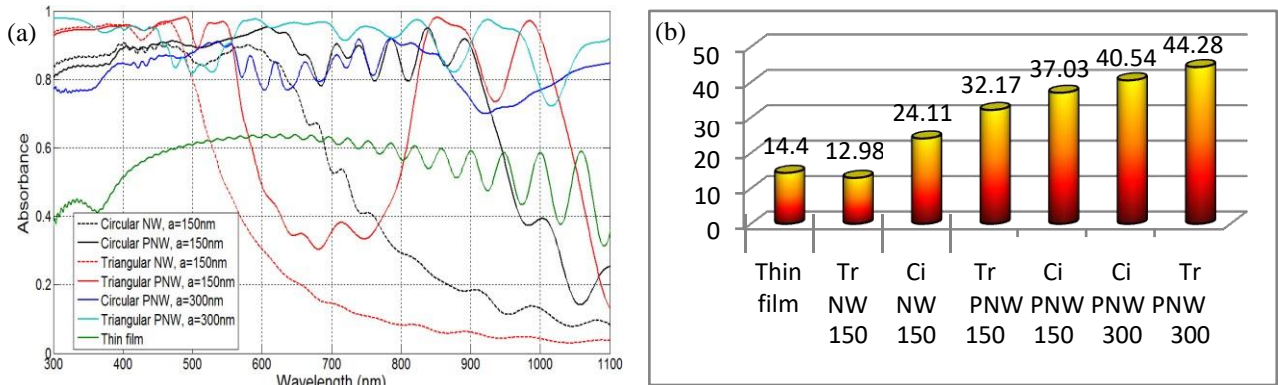


Fig 2: (a) Absorbance of thin film, circular and triangular NW, PNW for different periodicities 150nm and 300nm (b) Ultimate Efficiencies of thin film, Circular (Ci) and Triangular (Tr) NW, PNW for different periodicities showing maximum efficiency.

Fig 2 shows the Absorbance and Ultimate efficiency of c-Si NW, PNW and Thin film structures for fixed filling ratio and length. From Fig 2, we can see that as we increase the periodicity of the nanowires, the bandwidth of absorption widens leading to an improved Ultimate efficiency. We can also see that introducing silver as surface plasmon (PNW) as the core of nanowire further has wider absorption bandwidth when compared to conventional nanowire (NW) structures. The bandwidth for Triangular PNW is wider than the Circular PNW and hence triangular PNW has a higher Ultimate efficiency. After calculating the efficiencies, we were able to find 44.28% and 40.54% maximum Ultimate efficiency for Triangular PNW and Circular PNW at 300nm periodicity respectively.