Mechanical Simulation for Asymmetrical Waveguides for Concentrator Solar Cells

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1. Introduction

So far, many studies have been done in order to improve the efficiency of solar cells, and numerous types of photovoltaic devices have been reported. However, it is still difficult for us to convert the full sunlight spectrum into electricity. In order to solve this problem, we come up with a new solution which shall be of importance for the development of renewable energy society and greatly improve the efficiency of solar cells [1]. Being different from the conventional solar cells in which photons and photocarrier are absorbed parallelly, our new approach is that we make the photon and photocarrier absorbed orthogonally. The conventional solar cells suffer greatly from the mismatching in light absorption and photo-generated carrier collection, in our approach, the multi-striped orthogonal photon-photocarrier propagation solar cells can absorb more photons, meanwhile, the loss of photocarriers would be less. In our asymmetric waveguide [2] coupled concentrator solar cells, how to make spatially propagating light efficiently convert into waveguides is of vital importance. The waveguide we proposed is asymmetric, and better confinement of photons in the waveguide resulting in more photon harvesting. Now, the new waveguide structure with discrete translational symmetry is needed to be implemented.

2. Simulation

We propose to use polydimethylsiloxane (PDMS) which is transparent and durable. By adjusting the proportion of elastomer base and elastomer curing agent, we can make PDMS with distributed young`s moduli. We calculate the shape for a bar using Hari (software) with the distributed young`s moduli. The bar is fixed with one end (left) and a point on the bar is pushed down with "Force" in Fig1 and the result is shown to the right of Fig1. The pink is the target shape that goes good propagation in simulation [1,2], and the blue is the one obtained with Hari software with the distributed young`s moduli. In Fig1, the difference of those two curves is the green line, being almost zero, which means we can implement the target structure.

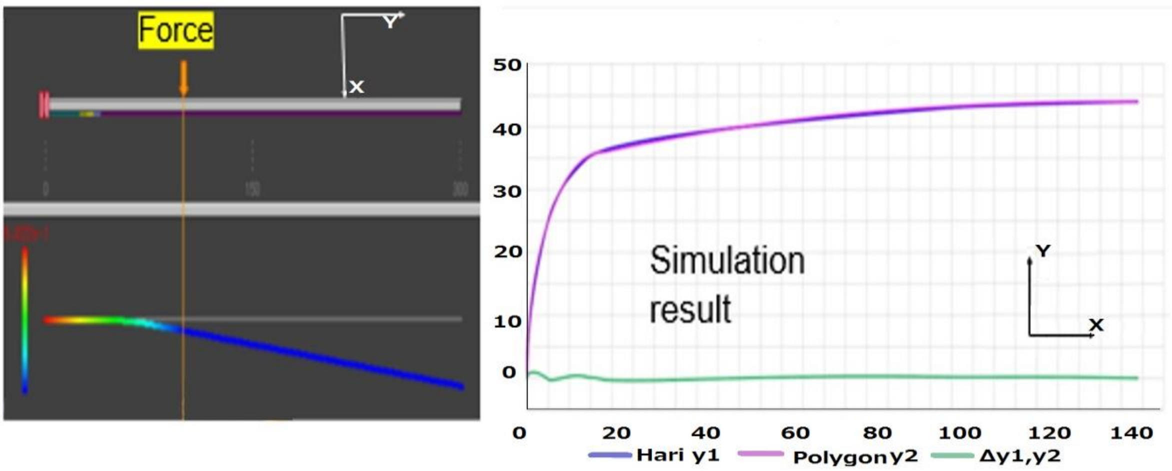

Fig 1 Simulations for a bar using PDMS (left top without force, left bottom with force) and simulation result (right).

3. Conclusion

Based on simulations, we have shown that using PDMS the waveguide structure can be achieved that goes good propagation. The new waveguide would serve, in the near future, as key component for concentrator solar cells.

References

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