Using Narrow Bandgap Semiconducting Nanoparticles to Increase Efficiency of Water Desalination

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Background

Why Use Narrow Bandgap Semiconductors?

When light hits a Narrow Bandgap semiconductors electron hole-pairs are promoted to the Conducting Band. When these electron-hole pairs relax to the band edge, energy is released in the form of heat. This allows for the more efficient use of the solar heat flux. Cadmium Selenide, a narrow bandgap semiconductor, is used in this project to test demonstrate these abilities compared to airlaid paper.

Results

By adding a narrow bandgap semiconductor to the flux surface of the airlaid paper, the heat that is retained at the surface is increased. Through this increase of latent heat, more energy is available to vaporize the water at the surface-air interface.

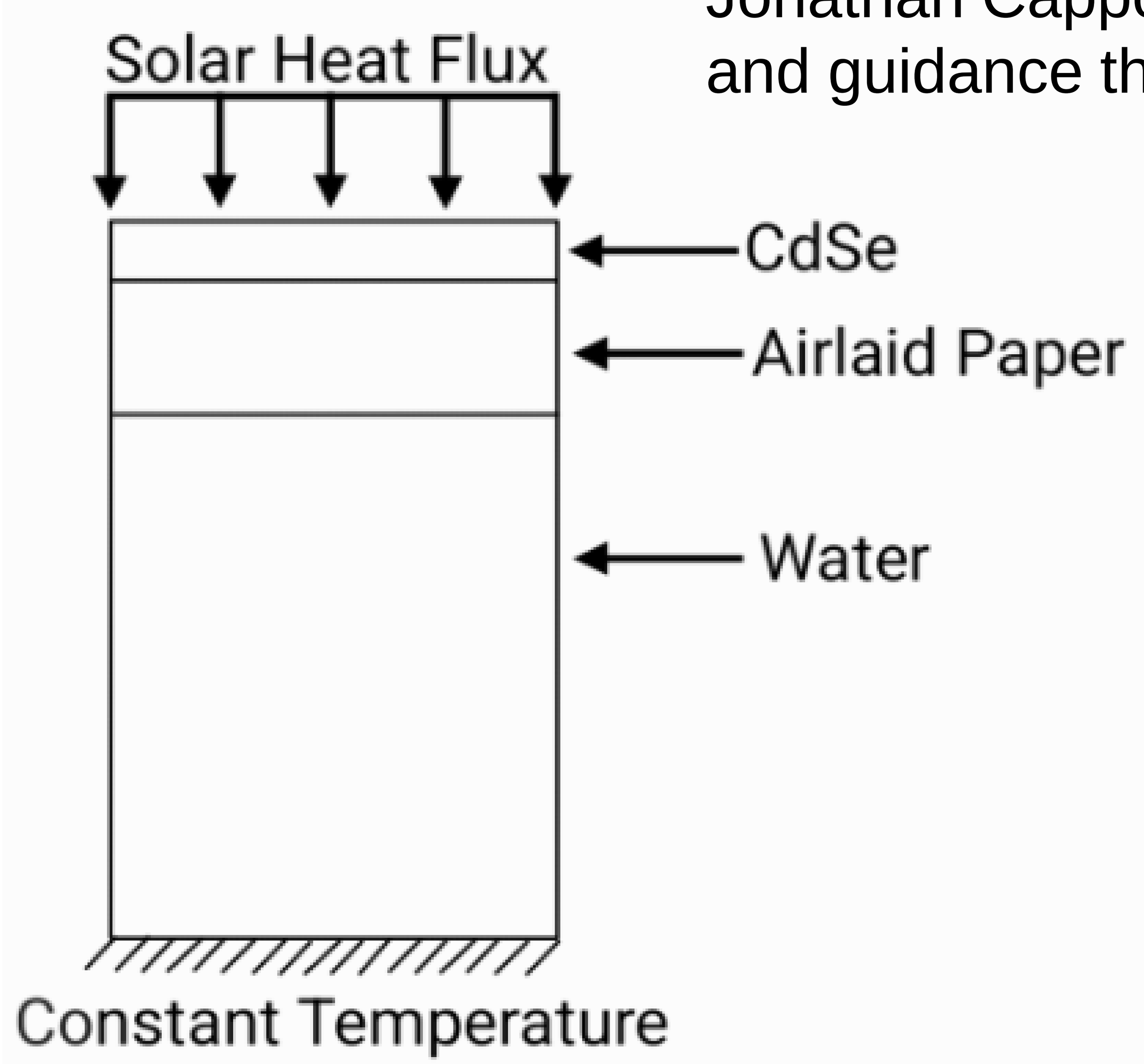
Material	Thermal Conductivity $(W/m^{-1}K^{-1})$
Cadmium Selenide	7.5
Airlaid Paper	0.03-0.05
Water	0.6

Methods

This study uses Abaqus Finite Element modelling to perform the necessary heat transfer calculations. Two models were created, one that integrates heat transfer through airlaid paper on water, and the other in which the paper has a coating of CdSe on the surface exposed to the solar heat flux.

Acknowledgments

I would like to thank Dr. Lin Li and Jonathan Cappola for their support and guidance throughout this project.



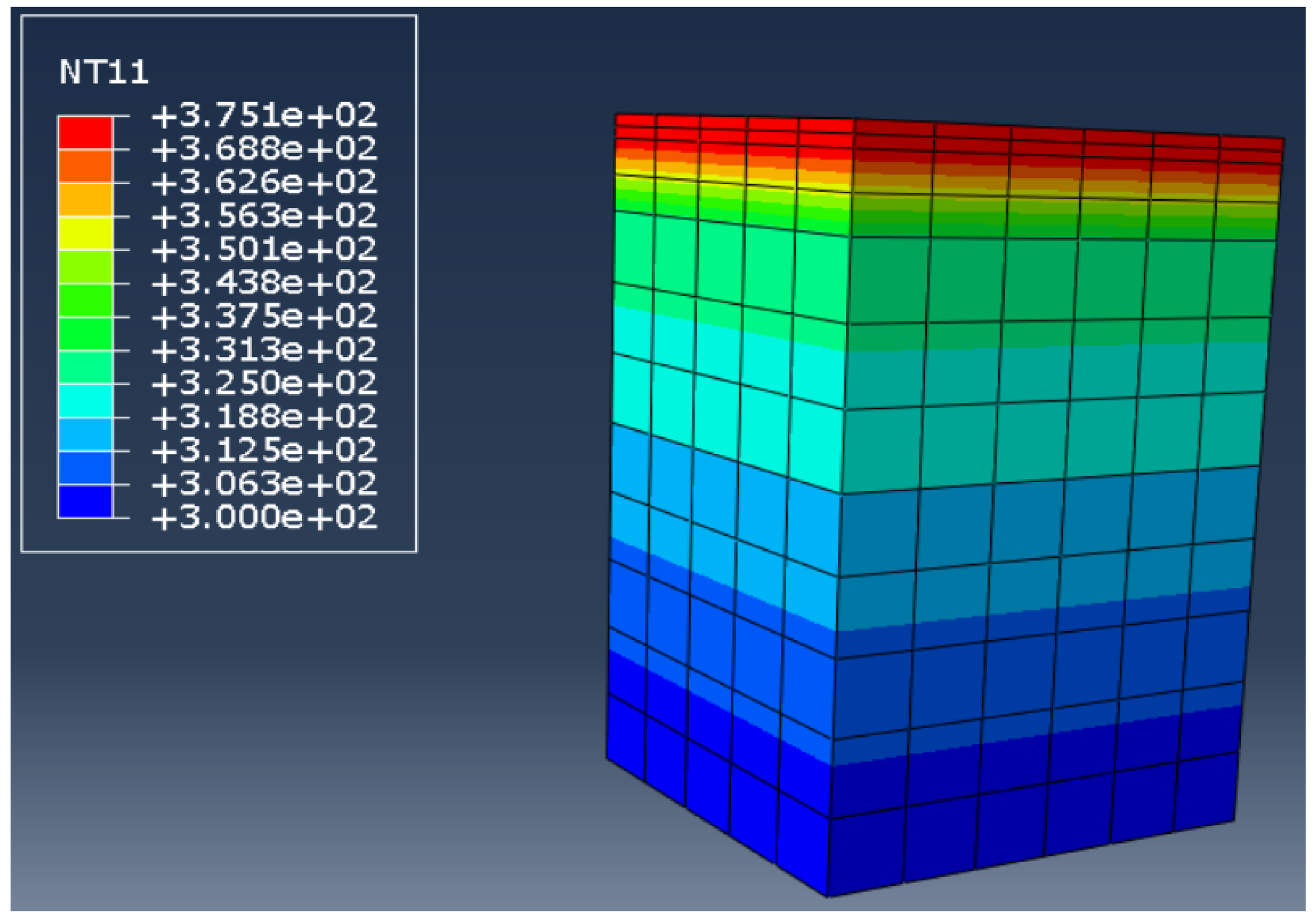


Figure 2: Airlaid Paper on water under heat flux.

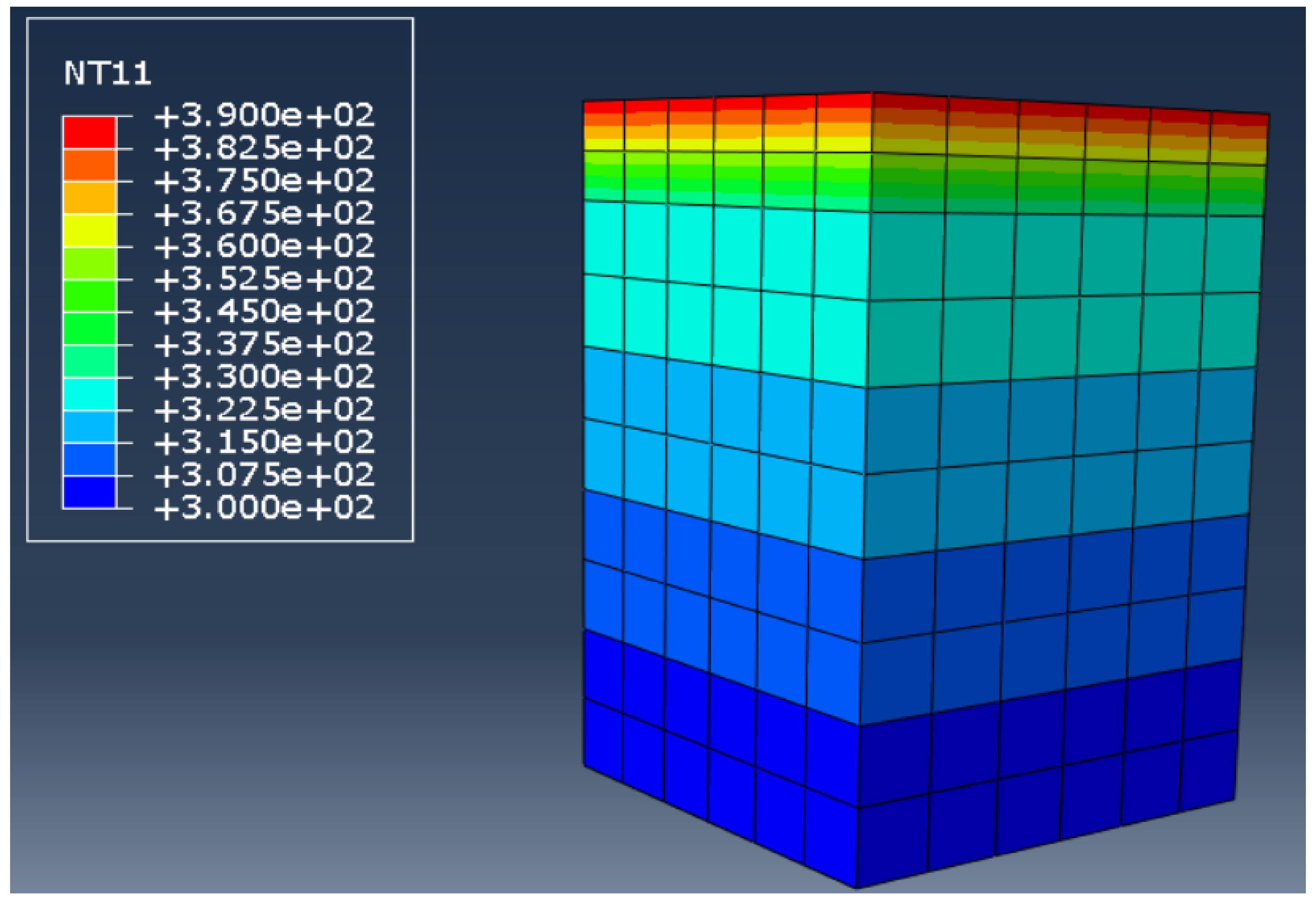


Figure 3: CdSe on Airlaid Paper on water under heat flux.

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