Notice of the Final Oral Examination
for the Degree of Master of Science

of

BRENDA BRADY

BSc (Dalhousie University, 2015)

“Amorphous Germanium Optical Cavity Solar Cells Enhanced by Plasmonic Nanoparticles”

Department of Physics and Astronomy

Thursday, December 14, 2017
2:00 P.M.
Elliott Building
Room 162

Supervisory Committee:
Dr. Alexandre Brolo, Department of Chemistry, University of Victoria (Supervisor)
Dr. Rogerio de Sousa, Department of Physics and Astronomy, UVic (Member)
Dr. Christo Papadopoulos, Department of Electrical and Computer Engineering, UVic (Outside Member)

External Examiner:
Dr. Nathan Lindquist, Department of Physics, Bethel University

Chair of Oral Examination:
Dr. Daniela Damian, Department of Computer Science, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

Thin-film photovoltaics are of great interest due to decreased manufacturing costs, improved environmental sustainability and the potential for flexible, semi-transparent, and light-weight modules. The scientific literature contains a plethora of work incorporating wavelength scale nanostructures within thin-film solar cells to increase power conversion efficiency by trapping light inside solar cell absorbing layers. One category of nanostructures, namely plasmonic nanoparticles, theoretically show great promise for their light-trapping abilities but experimental success has been limited. In this work, solar cells were designed and fabricated to incorporate multiple light-trapping mechanisms, including optical cavity resonances, waveguide mode excitation, and plasmonic effects. Due to our novel design considerations, we show unambiguous plasmonic-based enhancement mechanisms not previously demonstrated experimentally. The experimental results are complemented and confirmed by well-matching simulations which are used to further investigate the light-trapping mechanisms. The concepts demonstrated in this work can be directly translated to next-generation transition metal dichalcogenide photovoltaic devices.