Optimization of Plasmonic Structures in Silicon Solar Cells used in a Cogeneration System

E. Serra^*, *A. Paris*^*, *L. Calliari*^*, *A. Vaccari*^** *and A. C. Lesina*^**

^* *Interdisciplinary Laboratory for Computational Science (LISC), FBK-CMM and University of Trento – via Sommarive, 18 – 38123 Povo (Trento) - Italy*

^** *Renewable Energies and Environmental Technologies – via Sommarive, 16 - 38123 Povo (Trento) - Italy*

Abstract:

The development of high efficiency silicon solar cells with optical concentrators and integrated in a cogeneration system where the heating is used to scavenge the thermal energy is still an important issue for the energy production with renewable sources. The development chain for such devices comprises essentially the development of small area silicon cell, the concentrator system and the heat exchanger for the thermal fluxes recovery of heat generated inside the cell.

We focus our optimization process with the aid of modeFRONTIER software investigating the metal plasmonic structures used as antireflective coating of the solar cell. The absorption and scattering mechanism due to metal nanoparticles are simulated with the use of FDTD (Finite Differences in Time Domain) and DDA (Discrete Dipole Approximation) codes and a multi-objective optimization was applied to improve the internal quantum efficiency and the energy efficiency of the cell. This permits to enhance the overall efficiency of the system and its cost.

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