

**Title:** Design, Fabrication and Computational Analysis of Clamps and filters (Weather seals) to prevent roof leakage and rusting of materials in solar tile roofs.

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**Hypothesis/Project Problem:**

Solar roof tiles are photovoltaic cells which can convert the energy from the sun into electric power. These are different from traditional solar panels, as the traditional solar panels are combination of singular photovoltaic cells. The advantage of solar roof tiles over the traditional panels is the thickness and weight. Solar roof tiles look like normal roof tiles and light weight which makes them easy to install on most house roofs. Each of these tiles are connected in a series and connected to a charge controller which is then connected to a battery.

There are several companies which manufacture solar tiles i.e. Tesla (American Based Company), Solar Century (UK Based Company) and several Chinese companies. The most popular and latest tiles are Tesla's Version 3 solar tile and the C21E solar tiles by Solar Century. The C21E solar tiles have been used to make a Zero Energy house in Auckland, New Zealand. Although most of these tiles are in testing stages and none of them have entered mass production, there are already many issues and complaints during the initial roll out. These companies invest all their resources in improving the efficiency of the solar tiles, but nothing is done to improve the clamping systems and reduce the drilling on the roofs.

The main issues faced by the customers who install solar tiles are:

- Roof leakage
- Rusting of clamping and other parts
- Tilting of tiles due to heavy wind

The roof leakage is mainly due to drilling holes to fix the tiles which results in a small gap when one tile is installed on top of the other. This small gap allows dust and water to get through and eventually causes leakage and rusting of the elements. Due to drilling many holes in the roof the warranty of the roof is void. After a customer has installed the solar tiles it would be difficult for the customer to remove them because the roof would have several holes and would have to be replaced.

All the above-mentioned issues can be solved by making some design improvements in the clamping. This would reduce drilling holes in the roof and increase the stability of the system so that the tiles will not tilt due to heavy winds. The small gap between the tiles could be sealed by weather seals or filters in such a way that this is fitted with the tiles. So, making some design improvements in the tiles with some weather seals and improved clamping methods will solve the issues.

**Methodology:**

- The current design and fixing methods (clamps) used in the tiles should be properly studied.
- Improving the existing design for the clamping system of the tiles. This includes fabrication of new clamps where drilling is not necessary.
- Designing new filters (Weather Seals) to improve the water proofing.
- Selecting the materials for filters and clamps.
- Fabricating an improved tile (C21E Solar Tile) with new Weather seals attached to it. (Will need to buy two C21 Solar C21E tiles to attach the weather seal.)
- Computational analysis of new clamping system in Solidworks and prove that it is more stable than the traditional design and holds the tiles in heavy winds without tilting it.