The total production of waste in the European Union is about two thousand million metric tons, and this figure continues to rise. How to deal with the production of waste is a key issue when considering sustainable development and the destruction of the environment. Storing waste is not a sustainable approach to waste management, which must be based on reducing the production of waste through reusing and valorizing waste products.

One industry with a particularly promising future is the photovoltaic industry. The solar energy market is growing steadily and the trend worldwide is for this growth to accelerate. The photovoltaic modules used to produce solar energy contain several materials (such as glass, aluminum, silicon and a wide range of semiconductors) that can be recovered and reused either to make new modules or in other products.

In this paper we review the literature on the recycling of photovoltaic panels. We analyze the waste products generated by the industry (quantitatively and qualitatively) and examine the main techniques used for recycling. We conclude that two alternatives are currently considered for recycling photovoltaic modules: the recovery of materials to be reused in secondary applications, and the recovery of components that are of sufficient quality to be used in the production of new solar panels. In addition, it is believed that heat treatment is one of the most viable solutions from a technical, economic and environmental point of view.

We also conducted experiments to produce new cement-based materials with special properties by reusing the silicon from solar cells. We aimed to examine the effect of adding silicon from solar cells to two types of cement: Portland and calcium aluminate. In these experiments we produced cement pastes containing different...
percentages of recycled silicon, and we measured the times of onset and completion of setting. We also used test samples of mortar to measure the mechanical resistance, density, porosity and absorption of each one. Finally, we studied the process of hydration using different techniques: X-ray diffraction, infra-red spectroscopy and scanning microscopy.

The results indicate that the addition of solar-cell causes the system to expand, and that the presence of this waste affects how the material sets. Furthermore, the mechanical resistance to compression and bending are modified according to the proportion of waste added. Finally, the portland cement samples generate the same hydration products form, but the hydrated phases decrease as the percentage of solar-cell in the system increases. Furthermore, in mixtures of calcium aluminate, hydration products are modified depending on the content added.

**Keywords:** Photovoltaic module, solar cell, cement, silicon, recycle.