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Investigation of recycling possibilities of discarded photovoltaic solar panels

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The long-term growth of the installed capacity of solar photovoltaic energy production is now enhanced by both the current economic and energy crisis. The current global production of energy from solar photovoltaic panels is about 500 GW. In addition, it is expected to increase by up to 5 000 GW by the year 2050.¹ On the other hand, this source of energy is bonded with the production of waste in the form of old or discarded photovoltaic solar panels. In 2016, the mass of waste solar photovoltaic panels was estimated at 45 000 metric tonnes globally. By the year 2030 there is an expected mass of waste solar photovoltaic panels of 1.7–8 million metric tonnes and by 2050, 60–78 million metric tonnes.²

In the current market, the vast majority of photovoltaic panels sold are monocrystalline and polycrystalline types.³ Both photovoltaic solar panels have the same structure, consisting of an upper glass layer, a second bonding layer of poly(ethylene-vinyl acetate) (abbr. EVA), a third (middle) layer formed by silicon cells and other metals, a fourth layer of EVA and a fifth (final) layer of polyvinyl fluoride.⁴ According to mass composition, around 75% of a photovoltaic solar panel consists of glass, 10% of polymers, 10% of aluminium, 3% of silicon cells, 1% of copper, and significantly less than 1% is formed by silver (values are approximate).

Taking into account the economic value and mass content of individual fractions sparked interest as components of glass, metals, and silicon cells. The biggest current problem is the inefficient deliberation of individual layers and physical pre-treatment. This work aims to find an economically effective and industrially feasible method of how to recycle discarded photovoltaic solar panels. Performed experiments determined the exact composition of photovoltaic solar panels and the advantages and disadvantages of the treatment mentioned in the literature. Results will be used for a full-scale industrial unit design for solar photovoltaic panels recycling.

References

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