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Nowadays, there is an effort in chemistry to maximally utilize materials and energy without pollutant or toxic waste production. Photovoltaic panels (PV) belong to systems which use only solar energy to generate electricity in commercial and residential applications. PV panels have become very popular because they work without noise, material consumption and pollutants with government support. Their efficiency can exceeds 19% and lifetime 25 years. It is known, that up to 97% of contained semiconductors (mainly silicon) can be recovered. Nevertheless, the purity of regenerated silicon is usually not enough sufficient for semiconductor applications even for new PV panels. Troubles with purity and usage are also connected with recovered magnesium from automotive scrap.

This work is focused on preparation of magnesium silicide to purify silicon *via* waste-free route. Magnesium silicide was successfully prepared by the reaction between silicon from PV panels and magnesium from scrap. The synthesis was tested under various temperature, reaction time and atmosphere. Prepared samples of magnesium silicide were characterized by X-Ray diffraction, Raman spectroscopy, Scanning Electron Microscopy with Energy Dispersive X-Ray spectroscopy and compared with commercial standard. Magnesium silicide was then hydrolysed by phosphoric acid. Gaseous product (mixture of silanes) was characterized by Gas Chromatography – Mass Spectroscopy. The only by-product of hydrolysis is magnesium phosphate; a desired fertilizer. Prepared silane was thermally decomposed over hot platinum wire. Decomposition of silane into pure silicon and hydrogen was indirectly confirmed by Fourier Transform Infrared Spectroscopy. The mentioned process for silicon purification provides high purity silicon, hydrogen and magnesium phosphate. All three steps of process was successfully verified. The recovered high purity silicon can be used even for semiconductor applications. The obtained hydrogen can serve as a source of energy and magnesium phosphate can increase agricultural yields.

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References

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