Magnesium Silicide for Energy Storage and Recycling Technology.

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The silicides as binary compounds of silicon with less electronegative metals can be utilized in many industrial fields owing their mechanical, physical, chemical and thermoelectric properties as a function of their composition and structure. For example magnesium silicide can be used for energy storage. One of many routes for preparation of magnesium silicide involves mixing of powdered components and their heating under various conditions; e.g. a thermal treatment under vacuum or inert gas. As a possible source of raw material, silicon obtained by reutilization of photovoltaic panels and magnesium scraps could be used. Prepared magnesium silicide is then hydrolysed with diluted phosphoric acid to produce silanes and magnesium phosphate as a by-product. Thermal decomposition of silanes leads to hydrogen and silicon with a ultra-high purity. Formed magnesium phosphate can be with advantage utilized as a very effective fertilizer.

A series of magnesium silicide samples using starting materials with a various level of surface oxidation were prepared. The reaction was carried out under various conditions, e. g. temperature, reaction time, and gaseous environment. The prepared samples were characterized by a scanning electron microscopy, an energy dispersive X-ray spectroscopy, a photoelectron and Raman spectroscopy. The samples were then hydrolysed with a series of dilute acids solutions. The resulting gaseous products were characterized by a gas chromatography-mass spectrometry. The prepared samples of magnesium silicide and the products of hydrolysis were compared with the commercial standard. Silane, as one of the hydrolysis products, was thermally decomposed in a reaction cell using platinum wire and its loss and the formation of nano-silicon was observed.

The aim of this study is to optimize the reaction conditions that would ensure efficient and economical process. This could lead up to new design for photovoltaic panel recycling technologies, hydrogen production and storage.

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