OBTAINING OF POLYCRYSTALLINE SILICON FOR SEMICONDUCTOR INDUSTRY

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The authors of the project have been working on synthesis of silicon containing gases and semiconductor materials based on silicon since 1984. For the past 2 years work has been done at CPCMA, KSU. During this period the authors have received 10 author certificates and 2 patents.They have obtained new gases such as sililborane, sililethylene and worked out an alternative method of sililphosphin. There has been shown that these gases can be well used as doping for precipitating of amorphous hydrogenated silicones films. In this project, the authors present a method of obtaining polycrystalline silicon for semiconductor industry.

The purpose of the project is to create pilot equipment and optimize the process of obtaining polycrystalline silicon on semi-industrial level. In the past several decades, the historical experience in the developing countries has shown that one of the most promising ways to improve the economy of a country is to establish semiconductor industry. First of all, the results can help increase defense, national security and create industrial production.

The key issue of providing electronic products is the progress being made in material handling. Despite a great number of new semiconductor materials, silicon is and will be of the major importance, with its consuming continuously increasing. Foreign specialists estimate that by the year 2000 the shortage of semiconductor silicon will be over 20000 ton annually (not taking into account consuming in the former Soviet Union).

The silane method, which has been traditionally used for obtaining technical and polycrystalline silicon, is to obtain and then to pyrolyze mono-and polysilanes. Although the traditional methods of obtaining silicon hydrides have specific advantages, such as utilizing by-products, they also have clear shortcomings, i.e. either low output of the ultimate product (through hydrolysis of Mg2Si) or high contents of by-products in it (through disproportion of trietocsisilane) or high contents of dissolving vapors (through decomposing Mg2Si in non- water solutions).

In addition, the methods of obtaining magnium silicide, the original product used in synthesis of silanes, are far from perfect. A doubtless disadvantage in the method of obtaining Mg2Si from technical silicon (98%) and metal magnium is high cost of technical silicon. There is a method of obtaining Mg2Si by reaction of fine silicagel with magnium powder (the latter should be taken 10-12 % surplus in order to reduce the whole Si and to associate the oxygen) in reducing hydrogen environment at the temperature 500-600 (C (US Patent, #164350,C01B 33/04, published December 11, 1985). A disadvantage of this method is a high input of Mg, which influences the cost of the ultimate product.

The authors offer to conduct synthesis of magnium silicide from industrial ferrocilicium and metal magnium (applied for a patent in Republic of Kazakstan). Using ferrocilicium will allow to decrease Mg input, decrease the amount of impurity in it as well as utilize the reduced iron. Obtaining of mono- and poly silanes was conducted through a method which has 2 author certificates. This method is based on passing water vapor through a mixture of powder of Mg2Si and phosphorus oxide(V). This method allows to receive a high output (98%) of silicon hydrides, which have insignificant amount of water as admixture, and it is very easy to remove. In addition, the authors conducted a number of experiments on kinetics and mechanism of pyrolisys of gases containing silicium and polycrystalline silicon layer growth. If this project works out, it will allow to produce 200-300 tons of polycrystalline silicon of high level of purity in one year.

Eventually, the production can be increased up to 1000 tons annually. This may result in establishing industrial technology for obtaining polycrystalline silicon.