Draft ID Card for Silicon

Date: January 2009

Substance identification in REACH

2.	**IDENTIFICATION OF THE SUBSTANCE, Silicon** For each substance the information given shall be sufficient to enable each substance to be identified. If it is not technically possible or if it does not appear scientifically necessary to give information on one or more items below, the reason shall be clearly stated.
2.1	**Name or other identifier of substance**
2.1.1	Name(s) in the IUPAC nomenclature or other international chemical name(s**): Silicon, Silicon Refined, Silicon Standard, Si.**
2.1.2	Other names (usual name, trade name, abbreviation) **silicon, silicon metal, Si-metal, metallurgical grade silicon, electronic grade silicon (monocrystalline silicon), solar grade silicon, chemical grade silicon, polycrystalline silicon, silgrain HQ**
2.1.3	EINECS or ELINCS number (if available and appropriate) **231-130-8**
2.1.4	CAS name and CAS number (if available) **7440-21-3**
2.1.5	Other identity codes (if available): ISO or other standards
2.2	**Information related to molecular and structural formula of substance: Si**
2.2.1	Molecular and structural formula (including SMILES notation, if available) **Si**
2.2.2	Physical forms or particle distribution range. **Lumps, rocks, blocks, ingots, sized material in different grain sizes. Granules. Flakes. Briquettes, chunks and chips. Wafers** **Size 5 – 120 mm is typical for use in aluminium alloy** **Size 0 - 50 mm typical for chemical use** **Powder: 0-1500 μm**
2.2.3	Atomic weight or atomic weight range: **Si = 28.0 g/mole**
2.3	**Composition of substance**
2.3.1	Degree of purity (%) **95.1 % - 100 %**
2.3.2	Content of impurities **Fe: max 3.0%** **Ca: max 1.5%** **Al: max 1.5%**

	Mn:max 0.1 % **Ti: max 0.1%** **C: max 0.1%** **O : max 0.5 %** **P: max 0.1 %** **Mg: max 0.1 %** **Pb: max 0.1 %** **B: max 0.1 %** **Others: max 0.1 %**
2.3.3	Percentage of (significant) main impurities **See above**
2.3.4	Chemical nature and order of magnitude (…ppm, ….%) of any additives (e.g. stabilising agents or inhibitors)
2.3.5	Spectral data (ultra-violet, infra-red, nuclear magnetic resonance or mass spectrum)
2.3.7	Description of the analytical methods or the appropriate bibliographical references for the identification of the substance and, where appropriate, for the identification of impurities and additives. This information shall be sufficient to allow the methods to be reproduced. **Acid digestion + ICP** **XRF calibrated to international standards.** **ICP as a check of the XRF and to measure trace elements** **Atomic Absorption (AS)**
2.4	**Production method**
2.4.1	**Smelting process in an electric arc furnace.** **Typical raw materials are;** • **Elemental carbon like coal, charcoal, woodchips, petcoke, electrodes** • **SiO2 like quartz, sand, others** • **Limestone** **Silicon metal is commonly produced in low-shaft three phase submerged electric arc furnaces.** **The electric arc furnaces can be of the open or semi-closed type. The raw material is fed from storage bins above the furnace, through feeding tubes into the smelting zone around electrodes. The liquid metal is tapped off continuously or at regular intervals. The metal is cast from the ladle after the tapping is finished. The silicon alloy is then crushed by using jaw-; rotary or roll crushers or granulated in water. The production of silicon metal is almost slag free process. The refining step to obtain a higher purity metal takes place by oxidizing the impurities in the ladle.** **Polycrystalline silicon (PCS) is an hyper form of Silicon (99.9999999) produced for semi-conductor and solar cell**

	Industry. To produce PCS, metallurgical-grade silicon is reacted with hydrogen chloride gas (chlorination in special reactor) in the presence of a copper-containing catalyst to form trichlorosilane (SiHCl3). The trichlorosilane (TCS) is reduced to very pure silicon by reacting it with hydrogen at high temperatures (about 1100ºC). The procedure of extracting pure poly-crystalline silicon from trichlorosilane can be (among others) performed in special furnaces (ex.: Siemens). Furnaces are heated by electric current, which flows through (in most cases) silicon electrodes. Silane is a by-product of the decompostion of TCS. The "electronic grade" silicon has less than 1 ppb of impurities. **An alternative method is the pyrolysis (thermal decomposition) of silane inside a low-pressure reactor.** **A very pure Silicon metal is also produced by a patented hydrometallurgical process. This process removes the impurities in high silicon ferrosilicon by treatment in an iron chloride solution. The end product is a very pure quality silicon metal that consists of small grains measuring between 0 and 1 millimeter. A part of this metal undergoes further purification to produce a very pure silicon metal.**
2.4.2	Imported to EEA, describe production process (briefly) **Similar process as described above**
2.5	**State known use(s) of the substance.** **Silicon is produced in a low-shaft three phase submerged electric furnaces, by reducing high quality quartz with coke.** **Chemical reaction in Silicone industry: manufacture of silanes, silicones and silica.** **As a " hardener" or alloying element to produce aluminium alloys. These alloys are then used to make components parts, mostly for use in the various forms of transport vehicles, e.g. wheels, gear box housings, outer casings.** **Some aluminium/low silicon content alloys are used in building construction materials.** **Secondary smelting additive** **Manufacture of micro-processors** **Manufacture of solar cells** **Manufacture of substrates for use as a "silicon optical bench" in photonic devices** **Manufacture of Industrial refractories**