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Purified Si Film Formation from Metallurgical-Grade Si by Hydrogen Plasma Induced Chemical Transport[1]

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Purified Si film is prepared directly from metallurgical-grade Si (MG-Si) by chemical transport using subatmospheric-pressure H_2 plasma. The purification mechanism is based on the selective etching of Si by atomic H. Since most metals are not etched by H, this process is efficient to reduce metal impurities in Si films. It is demonstrated that the concentrations of most metal impurities (Fe, Mn, Ti, Co, Cr, Ni, etc.) in the prepared Si film are in the acceptable range for applying it to solar-grade Si (SOG-Si) material, or below the determination limit of the present measurements. On the other hand B and P atoms, which make volatile hydrogen compounds such as B_2H_6 and PH_3, are difficult to eliminate by the present principle. From the infrared absorption measurements of the etching product produced by the reaction between H_2 plasma and MG-Si, it is found that the main etching product is SiH_4. Therefore, a remote-type chemical transport process is possible to produce SiH_4 gas directly from MG-Si. Combining other purifying principle (such as a pyrolysis filter), this process may have an advantage to eliminate B_2H_6 and PH_3 from the produced SiH_4 gas.

[1]JST, CREST