Passivation of the silicon (100) surface by hydrogen termination: A comparison of surface treatments

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Abstract

Passivation of semiconductor surfaces is easily accomplished by terminating surface bonding with molecular atoms such as hydrogen using a basic wet chemical procedure (e.g. hydrofluoric acid treatment for silicon). The conventional silicon wafer passivation methods, standard RCA cleaning and hydrofluoric acid (HF) aqueous solution immersion, have been implemented to passive the surfaces of one type of impurities. In this regard, we show the surface passivation by various wet chemical etching of Si(100) substrates with varying doping concentrations.

Commercial HF aqueous solution diluted in various methods has been used to produce Si(100) surface as hydrogen-terminated. The passivation stability was checked by in detail with water contact angle measurement, synchrotron radiation- based X-ray photoemission spectroscopy (SR-XPS), Auger electron spectroscopy (AES) and Low-energy electron diffraction (LEED) was also used. From these results, we present the mechanism underlying the formation during wet cleaning processes of the hydrogen-terminated Si(100) surfaces. It studies the impact of the cleaning process on the passivation of silicon. For several cleaning sequences, a major improvement with varying Si(100) doping level in the passivated efficiency is found, even variations in cleaning efficiency are apparent.