Alternation of silicon properties by compression plasma flow action

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Development of optoelectronics is largely determined by search for new materials that would enable creation of photodetectors and light-emitting devices with essentially improved operating characteristics. The most promising trend in this area is modification of surface properties of materials widely used. So, initiated in the last $2-3$ years have been intensive studies on development of silicon-based light-emitting and amplifying systems by introducing dopants into the silicon lattice and controlling the surface morphology. Difficulties encountered in implementing such approaches call for development of new techniques for changing the material surface properties, as capabilities of available methods are practically exhausted. Radically new potentialities for modification of semiconductor properties are opened up through the exposure of the material to compression plasma flows produced by quasi-stationary plasma accelerators of a new generation, operating in an ion current transfer mode. By exposing the silicon wafers to a compression flow whose plasma carries magnetic field frozen in it, regular volumetric structures with diameter of $100-700$ nm and up to 300 microns in length have been obtained for the first time. Synthesis of such surface structures takes place due to both power and dynamic actions of a compression flow on silicon followed by crystallization of the melt under conditions of fast cooling in the presence of magnetic fields induced by "swept-away" currents. Such an effect upon the wafer was found to result in bandgap narrowing that may be due to constriction of the silicon lattice.

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