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KrF excimer laser 열처리를 이용하여 만들어진 확산 n+/p 접합에서 2차원적 불순물 분포에 관한 연구

(Two-dimensional dopant profiles in diffused n+/p junctions produced by KrF excimer laser thermal annealing)

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Solid-state diffusion (from phosphorous-doped amorphous Si as a diffusion source) coupled with a laser-thermal-process (LTP) is used to fabricate shallow n+/p junctions. Transmission electron microscopy (TEM) combined with selective chemical etching is employed to characterize two-dimensional (2D) dopant profiles in the n+/p junctions. TEM results show that amorphous Si is transformed into crystalline material, as the energy density of laser increases. For the energy density of 561 mJ/cm^2, the deposited film consists of the crystalline Si grains and the amorphous Si on the Si substrate. This implies that the energy density is not sufficient to penetrate the full thickness of the amorphous film. For the energy density of 721 mJ/cm^2, the whole amorphous Si film is transformed to crystalline material which is composed of large crystal grains. It is found that shallow junction is obtained with irradiation of one pulse of the laser with an energy density of 903 mJ/cm^2. As the energy density exceeds 1105 mJ/cm^2, the surface becomes rough with a hillock formed in the middle of the well region. Crystallographic defects such as dislocations and twins are observed in the re-grown area. The 2D dopant profile of the LTP sample is compared with that of the rapid-thermal-processed (RTP) sample.