Grain boundary energy anisotropy effect on microstructure of nanosilicon films

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As is known, the characteristics of the electronic devices, such as solar cells or thin-film transistors, which are fabricated from nanosilicon films, are directly connected with the structural properties of their grain boundaries.

In the present work, the effect of grain boundary energy on microstructural evolution in undoped nanosilicon films has been investigated by transmission electron microscope (TEM) and atomic force microscope (AFM).

Nanosilicon films were prepared by low-pressure chemical vapour deposition on thermally oxidized (100)Si wafers at deposition temperature 630^0C. The film thickness was ranged from 3 to 100 nm.

Effect of anisotropy of grain boundary energy on the nanosilicon films microstructure was carried by comparison of the our results, obtained by TEM and AFM studies, with the simulation results given in [2].

It has been shown that in films with equiaxed structure without preferential orientation (film thickness < 70 nm), boundary energy is isotropic. Grain boundary triple junctions angles are close to the value of $2\pi/3$.

In a highly [110] textured fibrous films (film thickness $\geq$ 70 nm) boundary energy anisotropy is critical to the structure formation. In this case the triple junction angles deviate significantly from $2\pi/3$. Films microstructure includes a large number of low angle boundaries and stable, higher order junctions. The characteristic feature the grain boundary structure is grain boundaries faceting.

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2. *Upmanyu M., Hassold G.N., Kazaryan A., Holm E.A., Wang Y., Patton B., Srolovitz D.J.* Boundary mobility and energy anisotropy effects on microstructural evolution during grain growth // Interface Science.-2002.-**10**.-P. 201-216.