

Effect of chemical etching on the morphology and surface quality of polycrystalline silicon for photovoltaics

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Abstract:

Wet chemical texturization of multicrystalline (mc-Si) silicon wafers in the acidic solution has been investigated. The novelty of this research is the triple reduction of the texturization process time with respect to the results presented in the literature. The HF:HNO₃:H₂O system is taking into account. Etching in such solution leads to the oval pits morphology of few micrometers size and gentle slope. Homogeneity of obtained structures depends on the process time and solution temperature, therefore, acidic texturing can not be fully determined as isotropic. A special attention has been drawn to the orientations close to [100], [110], [111] and thus to the density of atoms arrangement in the unit cell. Moreover, the detailed studies on the shape, size, slope, and distribution uniformity of the resulting surface structures after acidic texturization process were performed using Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) techniques. Maps of grain orientations were acquired using Electron Backscatter Diffraction (EBSD) technique. All results were compared with optoelectronic parameters such as the reflectance in the wavelength range 400-1000 nm and current-voltage characteristics. The presented method of acidic chemical texturization with strictly defined solution composition, temperature and process time, seems to be the most preferable way of surface modification due to its short time, low cost and possibility of texturing high amount of wafers limited only by the size of vessel.