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Influence of annealing atmosphere on crystallization of amorphous $Si_{1-x}Ge_x$ thin film by Raman spectroscopy

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ABSTRACT

The influence of annealing atmosphere on the crystallization behavior of amorphous structure in a-$Si_{1-x}Ge_x$ thin films was studied with Ra man spectroscopy. We annealed a-$Si_{1-x}Ge_x$ (x = 0, 0.14, 0.27) thin films at 800 °C under various atmosphere and observed change in Raman spectra. We confirmed that nitrogen-annealing atmosphere promotes crystallization of the a-Si film, however, the crystallization was not promoted in the annealing under Ar atmosphere and in vacuum.

In the case of a-Si thin films containing Ge atoms, the crystallization in the a-$Si_{1-x}Ge_x$ (x < 0.25) film was not promoted, although a-$Si_{1-x}Ge_x$ ($x \geq 0.25$) film was crystalized when the annealing in a N_2 atmosphere. However, crystallization of the a-$Si_{1-x}Ge_x$ (x =0, 0.14, 0.27) were not promoted by the annealing under Ar atmosphere or in vacuum. The distortion induced by the presence of Ge atoms in the random-network of $Si_{1-x}Ge_x$, at a content below 25%, stabilizes the amorphous structure and obstructs the crystallization even in the annealing under the N_2 atmosphere.

Keywords：amorphous structure; crystallization; Raman spectroscopy; silicon

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