

Citation List

Patent Literature

[0007]

Patent Literature 1: Japanese Patent Laid-Open No. 5-206558

Patent Literature 2: Japanese Patent Laid-Open No. 9-321310

Summary of Invention

[0007a] According to the first aspect of the invention, there is a laser annealing method comprising irradiating a non-single-crystal semiconductor film with a pulsed laser beam having a linear beam cross-sectional shape while scanning the non-single-crystal semiconductor film with the linear beam in a minor-axis direction of the linear beam, wherein

the linear beam has steepness portions located in minor-axis-direction end portions in a beam intensity profile, and the steepness portions are areas having intensities greater than or equal to 10% but smaller than or equal to 90% of a maximum intensity in the beam intensity profile, and

the irradiation is performed such that a minor-axis-direction width of the steepness portion which is one of the steepness portions and which is located on the rear side in the scan direction is 50 μm or smaller on an

irradiation surface of the non-single-crystal semiconductor film.

[0007b] According to the second aspect of the invention, there is a laser annealing apparatus comprising:

a laser light source that outputs a pulsed laser beam;

an attenuator that adjusts transmittance at which the attenuator transmits the pulsed laser beam; and

an optical system that shapes the beam cross-sectional shape of the pulsed laser beam and guides the shaped pulsed laser beam to an irradiation surface of a non-single-crystal semiconductor film, wherein

the optical system includes an optical member that shapes the beam cross-sectional shape of the pulsed laser beam to a linear beam having a high intensity area where the intensity is higher than or equal to a predetermined intensity in a beam intensity profile and an optical member that steepens at least a steepness portion which is one of steepness portions located in minor-axis-direction end portions of the linear beam and which is the steepness portion on the rear side in a scan direction in such a way that a minor-axis-direction width of the steepness portion is 50 μm or smaller on the irradiation surface of the non-single-crystal semiconductor film.

Technical Problem

[0008]

It is, however, difficult to completely eliminate the steepness portions even by using a mask, a slit, or a variety of optical systems. The steepness portions can be suppressed, for example, through optical member design, but an attempt of excessive suppression of the steepness portions, for example, through optical member design undesirably results in local formation of intensity impulses 151a, where the intensity steeply increases, at the minor-axis ends of a flat portion 151 in the beam intensity profile of a pulsed laser beam 150, as shown in Figure 8. On the other hand, when a mask or a slit is used, a diffraction phenomenon undesirably similarly causes formation of the intensity impulses 151a, where the intensity steeply increases, at the minor-axis ends of the flat portion 151 in the beam intensity profile of