Control of Impurity Diffusion in Semiconductors by Intensive IR Excitations

1. motivation

- Promotion of diffusion of a specific impurity by using resonance excitation at the impurity mode.
- Computer simulation

2. purpose

Selective impurity diffusion by IR excitation

- First attempt of IR excitation of O by SPring-8
- Power consideration

3. diffusion length

Intensity of laser power

For an atom

\[
P_{\text{ion}} = \frac{\alpha}{\Delta \omega} \exp(-\frac{\Delta \omega}{\omega}) \exp(-\frac{\lambda}{\lambda_0})
\]

\[\tau_{\text{pulse}} = 0.15 \mu\text{W/cm}^2 \text{ at } 1000 \text{ cm}^{-1}\]

4. power balance

Power Dependence

- \(\text{BL43IR} \times \text{IR} \times 0.5\) (W/cm²)

5. power consideration

- Power Dependence

- Design of light source

6. power required

Intensity of laser power

For an atom

\[
P_{\text{ion}} = \frac{\alpha}{\Delta \omega} \exp(-\frac{\Delta \omega}{\omega}) \exp(-\frac{\lambda}{\lambda_0})
\]

\[\tau_{\text{pulse}} = 0.15 \mu\text{W/cm}^2 \text{ at } 1000 \text{ cm}^{-1}\]

7. estimate

- Power Dependence

- Simulation of light source

8. apparatus

Beam data

- BL43IR

9. beam data

Beam data

- BL43IR

10. sample

Samples

- IR illumination

11. result

Detection of change in diffusion by SIMS depth profile

- SIMS depth profile for B

12. Summary

- First attempt of IR excitation of impurity diffusion has been failed.
- The most significant error comes from the estimate of the input power at the sample.
- The present experience of power estimation could bring about success in the next stage of experiments.