Background

![Diagram of Photoluminescence Phenomenon]

1. Electrons are excited into conduction band
2. Electrons fall back into valence band and emit photons

Why does the absorption coefficient matter?
Operation of silicon solar cells is based on the excited electrons in the conduction band. These electrons are the result of optical absorption. Thus, the absorption coefficient $\alpha$ is the most direct parameter for characterisation models.

Why the photoluminescence (PL) method?
Extremely sensitive → allow to accurately determine extremely low values of $\alpha$ - several orders of magnitude smaller than the conventional method (transmission and reflection measurement) [1].

REFERENCE:

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How does the PL spectroscopy system work?
- Laser excites electrons in the sample via process 1.
- Sample emits photons via process 2.
- Photons are guided into a monochromator to filter out only desired wavelengths, which are captured by a detector.
- The captured spectra are analysed to extract $\alpha$.

Results

![Graph of PL Signal vs. Wavelength]

Fig. 4: PL spectra captured at different temperatures

![Graph of Absorption Coefficient vs. Wavelength]

Fig. 5: Absorption coefficient at different temperatures

We have established:
- Complete dataset of absorption coefficient $\alpha$ in working temperature range of silicon solar cells
- Formula to describe temperature dependence of absorption coefficient $\alpha$