

Photoluminescence Imaging: Shedding Light on the Invisible Defects in Silicon

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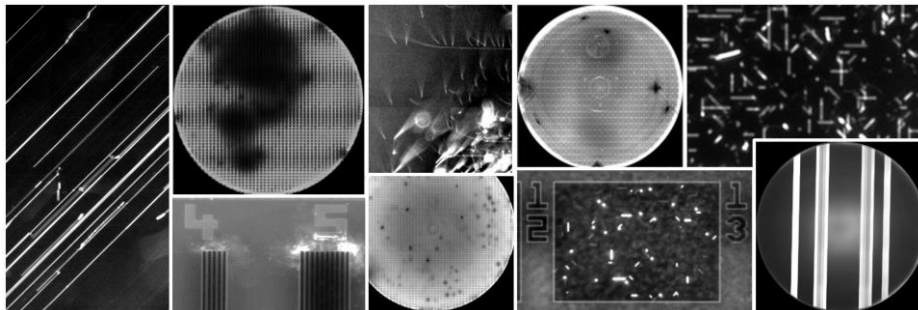
Photoluminescence (PL) stands as a powerful optical method for characterizing silicon and III-V semiconductors, providing valuable insights into material quality, semiconductor band-gap, and local dynamics. Originating in the photovoltaic industry, the specific PL imaging technique has now permeated silicon CMOS manufacturing, reshaping defect analysis through its non-destructive capabilities.

Unlike traditional PL spectroscopic methods, room temperature PL imaging leverages bandpass optical filters to swiftly capture spatially resolved data integrated across a wide range of wavelengths. This approach enables rapid acquisition of large sample areas with spatial resolution and sensitivity surpassing the limitations of conventional scanning PL systems with in-line observation of non-visual buried defects being a typical CMOS application.

During this presentation, STMicroelectronics' expertise in PL imaging will be illustrated, highlighting its pioneering role in detecting and characterizing silicon defects induced by ionic implantation [1-3] and exploring novel applications within the CMOS manufacturing environment:

- Silicon crystallographic defects originating from epitaxy [4], thermal treatments [5] and stress induced by patterning
- Substrate defectivity: BMDs, Oi precipitates
- Substrate metallic contamination [6, 7]

Embark on a journey into the realm of photoluminescence to uncover the transformative potential of this technology in semiconductor manufacturing.



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4. Frascaroli, et al. (2022). Automatic defect detection in epitaxial layers by micro photoluminescence imaging. IEEE Transactions on Semiconductor Manufacturing, 35(3), 540-545.
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7. Alcaire, T., et al. (2022, May). Full Wafer Process Control Through Object Detection Using Region-Based Convolutional Neural Networks. In 2022 33rd Annual SEMI Advanced Semiconductor Manufacturing Conference (ASMC) (pp. 1-5). IEEE.

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