
Spectrally Stable, High-Performance Pure Blue Light-Emitting Diodes from Mixed Cl/Br Halide Quasi-Two-Dimensional Perovskites


A Data Management Plan created using DMPonline.be

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Project abstract:

In this project, we aim to develop perovskite-based spectrally stable high-performance pure blue LEDs. This research objective will enable the development of perovskites LEDs-based cost-effective next-generation lighting and display technologies. Despite achieving the perovskite green/red/NIR LEDs with EQEs > 20%, blue LEDs have been lagging far behind in their performance, and, efficient blue emission <465 nm has not yet been achieved. Mixed 'Cl/Br' halide perovskite-based blue LEDs, the current standard, show emission above 465 nm and suffer from severe spectral instability due to ion migration and phase segregation. Here, I will design highly efficient and spectrally stable mixed 'Cl/Br' halide quasi-2D perovskite (Q2DPe) pure blue emitters ~ 440 - 470 nm through chlorinated BOCs shielding and excess Cl incorporation with homogeneous halide distribution by novel compositional engineering and unique processing conditions. Furthermore, I will study LED test structures with different charge transport layers and reduce the energy band offset at the perovskite interface through interface engineering to achieve efficient and balanced charge carrier injection, eventually resulting in spectrally stable high performance pure blue LEDs. The project outcomes will be efficient Q2DPe pure blue emitters and spectrally stable high-performance pure blue LEDs with EQE > 15%, luminance > 50000 cd/m², and lifetime > 500 h at 500 cd/m², which largely exceeds the current state-of-the-art.

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Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

Dataset name / ID	Description	New or reuse	Digital or Physical data	Data Type	File format	Data volume	Physical volume
		Indicate: N (ew data) or E (xisting data)	Indicate: D (igital) or P (hysical)	Indicate: A udiovisual I mages S ound N umerical T extual M odel S oftware O ther (specify)		Indicate: <1GB <100GB <1TB <5TB >5TB NA	
Experimental characterization data	Materials optical, structural, morphological, electronic properties, and LED device data	N	D	N I	.csv, .xls, .txt .tiff .jpeg	< 100 GB	
Images and videos	digital photo images of thin films and solutions under ambient and UV lights, LED images under operation	N	D	I	.tiff .jpeg .mp4	< 100 GB	
Confocal and widefield microscopy	Imaging files from microscopes	N	D	I	.tiff .jpeg .mp4	< 1TB	
Reports	Electronic lab notebooks, data analysis reports, presentation files, figures, posters and manuscripts	N	D	T/N	.txt .docx .pdf .ppt .txt	< 100 GB	

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

NA.

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.

- No

NA.

Will you process personal data? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).

- No

NA.

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.

- Yes

If any synthesis/design methodologies of pure blue emitters and efficient LED device designs will be obtained of interest for commercial valorization, corresponding IP restriction will be claimed.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material or Data transfer agreements, Research

collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

NA.

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g. in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, codebook.tsv etc. where this information is recorded).

An overview of synthesis protocols, experimental methods, thin film preparation details will be recorded in lab note books.
Experimental data including various materials characterization data, and LED device data will be stored on KU Leuven servers.
Microscopy imaging files (confocal and widefield) will be stored on KU Leuven servers.
Overall, a list of the data files with titles will be prepared in a .csv file or .txt file, will be stored along with the main data on KU Leuven servers.

Will a metadata standard be used to make it easier to find and reuse the data?
If so, please specify which metadata standard will be used.

If not, please specify which metadata will be created to make the data easier to find and reuse.

- Yes

KU Leuven Research Data Repository (RDR).

Data Storage & Back-up during the Research Project

Where will the data be stored?

- Shared network drive (J-drive)
- Personal network drive (I-drive)
- OneDrive (KU Leuven)

How will the data be backed up?

- Standard back-up provided by KU Leuven ICTS for my storage solution

Is there currently sufficient storage & backup capacity during the project?

If no or insufficient storage or backup capacities are available, explain how this will be taken care of.

- Yes

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The KU Leuven servers are protected from unauthorized persons.
OneDrive: Sharing the folders with the relevant persons only.
J-drive: protected with password on folder.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

NA.

Data Preservation after the end of the Research Project

Which data will be retained for 10 years (or longer, in agreement with other retention policies that are applicable) after the end of the project?

In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

- All data will be preserved for 10 years according to KU Leuven RDM policy

Where will these data be archived (stored and curated for the long-term)?

- KU Leuven RDR
- Shared network drive (J-drive)
- Large Volume Storage (longterm for large volumes)

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

NA.

Data Sharing and Reuse

Will the data (or part of the data) be made available for reuse after/during the project?

Please explain per dataset or data type which data will be made available.

- Yes, as restricted data (upon approval, or institutional access only)

Some data related to scientific publications will become available when published.

Other data can be obtained by researchers after request and approval by the PI (Sandeep Kumar Gundam) and supervisor Prof. Johan Hofkens.

If access is restricted, please specify who will be able to access the data and under what conditions.

Only members of our own research group under the supervision of Prof. Johan Hofkens.

Researchers can access the data after request.

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)?

Please explain per dataset or data type where appropriate.

- Yes, intellectual property rights

Where will the data be made available?

If already known, please provide a repository per dataset or data type.

- KU Leuven RDR (Research Data Repository)

When will the data be made available?

- Upon publication of research results

Which data usage licenses are you going to provide?

If none, please explain why.

- Other (specify below)

To be specified later.

Do you intend to add a persistent identifier (PID) to your dataset(s), e.g. a DOI or accession number? If already available, please provide it here.

- Yes, a PID will be added upon deposit in a data repository

What are the expected costs for data sharing? How will these costs be covered?

N/A.

Responsibilities

Who will manage data documentation and metadata during the research project?

Sandeep Kumar Gundam (Postdoctoral Fellow)

Who will manage data storage and backup during the research project?

Sandeep Kumar Gundam (Postdoctoral Fellow) and other researchers of the same group who work in collaboration directly with this project.

Who will manage data preservation and sharing?

Sandeep Kumar Gundam (Postdoctoral Fellow)

Who will update and implement this DMP?

Sandeep Kumar Gundam (Postdoctoral Fellow)