

Data set about *Separate and Combined Effect of Gua⁺ and SCN⁻ Ions on the Carrier Transport in Mixed Sn-Pb Perovskites*

Title: *Separate and Combined Effect of Gua⁺ and SCN⁻ Ions on the Carrier Transport in Mixed Sn-Pb Perovskites*

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Description: Data for the XRD, XPS, UV-Vis-NIR spectroscopy, SSMC and TRMC results, as well as the SEM images, in the main manuscript and Supporting Information under review in *Journal of Materials Chemistry A*.

The raw data were collected in the years 2024-2025, using various structural, compositional, and optoelectronic characterization methods on solution-based spin-coated mixed tin-lead (Sn-Pb) perovskite thin films with varying combinations and concentrations of tin fluoride (SnF₂), guanidinium thiocyanate (GuaSCN), guanidinium iodide (GuaI), and lead thiocyanate (Pb(SCN)₂) additives, alongside absorption spectroscopy analysis on perovskite precursor solutions. All measurements were conducted at room temperature, to study the separate and combined effect of the different additives. More specifically, all SSMC and TRMC measurements were conducted under nitrogen. The xy data obtained from X-ray diffraction (XRD), UV-Vis-NIR spectroscopy, and X-ray photoelectron spectroscopy (XPS) were imported into Igor Pro (Wavemetrics). In Igor Pro, these xy data are stored as "waves," corresponding to the values on the x and y axes in the plots. Data for Steady State Microwave Conductance (SSMC) and Time-Resolved Microwave Conductivity (TRMC) were collected directly as waves in Igor Pro on the computers connected to the respective microwave-based setups. Igor Pro was used to generate all data plots. The SEM micrographs were directly saved as .tiff files from the SEM software.

For further information on file formats and naming, the units and abbreviations used for all measured values and labels, and instructions for opening or modifying Igor Pro files, please refer to the README.pdf included in the dataset. It is strongly recommended to consult the corresponding manuscript once it is published (the corresponding DOI will be provided as soon as possible) for guidance on the files in these datasets, as each file name includes a reference to its associated figure. The main manuscript and Supporting Information contains details about the characterization instruments and additional data processing specifics.

Format: Igorfile/pxp; image/jpg; image/tiff

The Igor files were produced by Igor Pro 9 by Wavemetrics. This software needs to be used to open the .pxp files, using Igor Pro Demo (valid for 30 days) or the version with license. Alternatively, an open-source reader like Python can be used, installing the *igor* or *pyigor* package:

Bash

```
pip install igor
```

Python

```
from igor.binarywave import load
data = load("file.pxp")
```

```
print(data)
```

Bash

```
pip install pyigor
```

Python

```
from pyigor import load
data = load("file.pxp")
print(data.keys())
```

Naming convention:

The X-ray Diffraction (XRD) data present the following naming convention:

XRD_*X*SnF2_*additives*_Dep*X*_Fig*X*.

For the XRD data used in the SI regarding the crystal phase identification, the nomenclature is different, namely: XRD_*name*_comparison_Fig*X*.

The data for the lattice parameter and FWHM of the XRD peaks, related to the XRD data, present the following naming convention:

Latticeparameter_FWHM_*X*SnF2_*additives*_Dep*X*_Fig*X*.

The X-ray Photoelectron Spectroscopy (XPS) data present the following naming convention:

XPS_*elementorbitals*_depthprofiling_*X*SnF2_*additives*_Dep*X*_Fig*X*.

The UV-Vis-NIR spectroscopy data present the following naming convention: UV-Vis_*X*SnF2_*additives*_Dep*X*_Fig*X*.

The absorption spectroscopy in solution present a slightly different naming convention, namely: Abs in solution_SnI4_wandwoPb(SCN)2_Fig*X*.

The Steady State Microwave Conductance (SSMC) and Time-resolved Microwave Conductivity (TRMC) data present the following naming convention:

SSMC+TRMC_*X*SnF2_*additives*_Dep*X*_Fig*X*.

The data concerning DepC (GuaSCN) are divided in two different .pxp files depending on the GuaSCN addition. In this case, the name of the files also present in the name the specific concentration of GuaSCN as *X*GuaSCN.

The intensity-dependent TRMC traces data present the following naming convention:

AllTRMC_*X*SnF2_*additives*_Dep*X*_Fig*X*.

The Scanning Electron Microscopy (SEM) images present the following naming convention: SEM_*X*SnF2_*additives*_Dep*X*_Fig*X*.

The data for the grain sizes, related to the SEM images, present the following naming convention: Grain size_*X*SnF2_*additives*_Dep*X*_Fig*X*.

Sometimes the name of the SEM images also present the specific magnification as *XX*x. This is 20x if not stated in the name.

Important symbols and abbreviations:

- SnF₂ = tin(II) fluoride
- GuaI = guanidinium iodide
- Pb(SCN)₂ = lead(II) thiocyanate
- GuaSCN = guanidinium thiocyanate
- SnO_x = tin(II) oxide and tin(IV) oxide species

- 2θ = diffraction angle (°)
- a = cubic lattice parameter (nm)
- FWHM = full-width half-maximum of the XRD peaks (°)
- $O.D.$ = optical density (absorbance) (-)
- F_A = fraction of absorbed light (absorptance) (-)
- E_g = bandgap energy (eV)
- λ = photon wavelength (nm)
- G = conductance (S)
- β = microwave cell form factor (-)
- e = elementary charge (C)
- I_0 = laser light intensity (cm⁻²)
- σ_{dark} = dark conductivity (S m⁻¹)
- p_0 = dark holes concentration (cm⁻³)
- $\Sigma\mu$ = carrier mobilities sum (cm² V⁻¹ s⁻¹)
- $\tau_{1/2, TRMC}$ = carrier lifetimes (ns)
- L_D = carrier diffusion length (μm)
- D = grain size (nm)
- $\langle D \rangle$ = average grain size (nm)
- E_b = binding energy (eV)

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