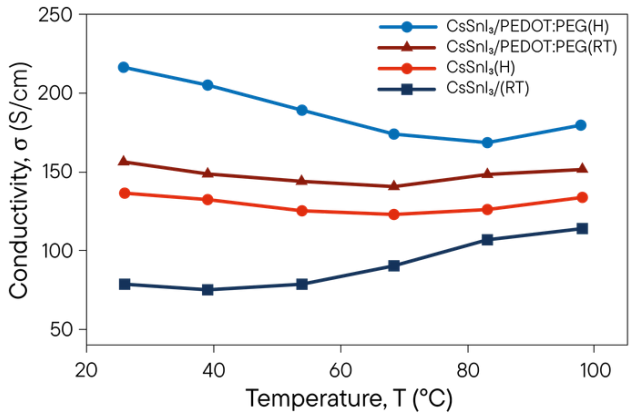
Temperature-Dependent Conductivity of Tin Perovskites

Electrical Transport Analysis of $CsSnI_3$ Thin Films

Tin-based halide perovskites offer promising electronic and thermoelectric properties, but their performance strongly depends on charge transport and material processing. In this study, pristine and PEDOT $CsSnI_3$ thin films were investigated to determine how organic modification and hot-casting influence their temperature-dependent electrical conductivity and thermoelectric properties.

Measurement Setup

- Material: $CsSnI_3$ and $CsSnI_3$/PEDOT thin films
- Samples: Room-temperature (RT) and hot-cast (H) films
- Temperature Range: Approx. 25–100 °C
- Measurement: Electrical Conductivity
- Application: Thin-Film Thermoelectric Materials



The measurements reveal a strong influence of PEDOT modification and hot-casting on the electrical conductivity of $CsSnI_3$.
Key observations include:

- Highest conductivity for hot-cast $CsSnI_3$/PEDOT
- Conductivity exceeding 200 S/cm at low temperatures
- Improved electrical transport through organic modification
- Strong influence of processing conditions on conductivity

The results demonstrate that organic modification combined with optimized processing can significantly enhance charge transport in tin-based perovskite thin films.

Interpretation

The observed behavior can be attributed to:

- Increased carrier density
- Enhanced charge-carrier mobility
- Improved film crystallinity
- Interaction between PEDOT and $CsSnI_3$

This results in:

- Higher electrical conductivity
- Improved thermoelectric performance
- Tunable electronic transport properties

Industrial Relevance

Electrical and thermophysical characterization supports:

- Thermoelectric material development
- Thin-film electronics
- Energy harvesting
- Perovskite research
- Functional semiconductor materials

Conclusion

The measurements demonstrate that PEDOT modification combined with optimized hot-casting significantly improves the electrical transport properties of $CsSnI_3$ thin films. Enhanced carrier density, mobility and crystallinity contribute to high conductivity and improved thermoelectric performance, highlighting the potential of modified tin perovskites for next-generation energy conversion and electronic applications.

Source:
Haque, M.A., Zhu, T., Hernandez, L.H. et al.
Inorganic Tin Perovskites with Tunable Conductivity Enabled by Organic Modifiers.
Adapted from thermoelectric characterization of $CsSnI_3$-based thin films. In-plane thermal conductivity measurements were performed using a LINSEIS Thin Film Analyzer (now designated as TFA L59).