

Comparison between Base Model and Domain-Adaptive Model

Prompt 1

Prompt:

List the best thermoelectric materials today and compare the top five in terms of Seebeck coefficient, electrical conductivity, and thermal conductivity.

Base Model (Model 1) - Response 1

The best thermoelectric materials today are bismuth telluride (Bi₂Te₃), lead telluride (PbTe), and silicon germanium (SiGe). The top five thermoelectric materials are listed below in order of Seebeck coefficient, electrical conductivity, and thermal conductivity.

Advantages of Bi₂Te₃:

Bi₂Te₃ has a high Seebeck coefficient, which means it can generate a large voltage from a small temperature difference.

Bi₂Te₃ has a high electrical conductivity, which means it can carry a large current.

Bi₂Te₃ has a low thermal conductivity, which means it can dissipate heat well.

Disadvantages of Bi₂Te₃:

Bi₂Te₃ has a low thermal conductivity, which means it can dissipate heat well.

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Bi₂Te₃ has a low thermal conductivity, which

Domain-Adaptive Model (Model 2) - Response 1

The best thermoelectric materials today are bismuth telluride (Bi₂Te₃), lead telluride (PbTe), and silicon germanium (SiGe). The top five thermoelectric materials are listed below in order of Seebeck coefficient, electrical conductivity, and thermal conductivity.

Advantages of Bi₂Te₃:

High Seebeck coefficient

High electrical conductivity

High thermal conductivity

Disadvantages of Bi₂Te₃:

High cost of production

High cost of maintenance

Advantages of PbTe:

High Seebeck coefficient

High electrical conductivity

High thermal conductivity

Disadvantages of PbTe:

High cost of production

High cost of maintenance

Advantages of SiGe:

High Seebeck coefficient

High electrical conductivity

High thermal conductivity

Disadvantages of SiGe:

High cost of production

Model Evaluation: Thermoelectric Materials QA

High cost of maintenance

Evaluation - Prompt 1

Model 1 Score: 5/10

- Identifies 3 materials but not 5.
- No numerical comparison of properties.
- Repetitive content.
- No analysis of PbTe or SiGe.
- Mentions advantages of Bi₂Te₃.

Model 2 Score: 6.5/10

- Slightly better organization.
- Incorrectly lists high thermal conductivity as an advantage.
- Lists pros/cons for all three materials.
- Still lacks numeric data.

Prompt 2

Prompt:

Explain why these thermoelectric materials are considered the best-what individual properties enhance their performance and quantify their contributions.

Base Model (Model 1) - Response 2

The thermoelectric effect is the direct conversion of temperature differences to electric voltage and of electric current to temperature differences. A thermoelectric device creates a voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, it creates a temperature difference (a heat flux) between its sides. It can be used as a generator of electricity through the Seebeck effect, or as a refrigerator through the Peltier effect. The performance of thermoelectric devices is typically quantified by the dimensionless figure of merit ZT. The best thermoelectric materials have ZT values of 3 or greater. The thermoelectric effect is the direct conversion of temperature differences to electric voltage and of electric current to temperature differences. A thermoelectric device creates a voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, it creates a temperature difference (a heat flux) between its sides. It can be used as a generator

Domain-Adaptive Model (Model 2) - Response 2

The thermoelectric effect is the direct conversion of temperature differences to electric voltage and of electric current to temperature differences. A thermoelectric device creates a voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, it creates a temperature difference (a heat flux) between its sides. It can cool one side and heat the other. It works by pressing two different types of materials against each other. The materials are selected so that one conducts electricity better than the other. When a temperature difference exists between the materials, a difference in charge carrier density occurs. This produces an electric voltage. The voltage is proportional to the temperature difference, and can be calculated as: where is the Seebeck coefficient, is the temperature difference, and is the absolute temperature. The Seebeck coefficient is also known as the thermoelectric power or the thermoelectric force. The Seebeck effect was discovered in 1821 by Thomas Johann Seebeck. The Seebeck effect is the

Model Evaluation: Thermoelectric Materials QA

Evaluation - Prompt 2

Model 1 Score: 5.5/10

- Defines thermoelectric effect and ZT.
- Copies prompt and repeats paragraphs.
- No mention of specific materials or property values.
- Ends abruptly.

Model 2 Score: 7/10

- Better physics explanation and flow.
- Mentions Seebeck coefficient and charge carrier effects.
- Still no mention of specific materials or quantified values.
- Ends abruptly.