PHASE CHANGE COMPOSITES AS EFFECTIVE THERMAL INTERFACE MATERIALS

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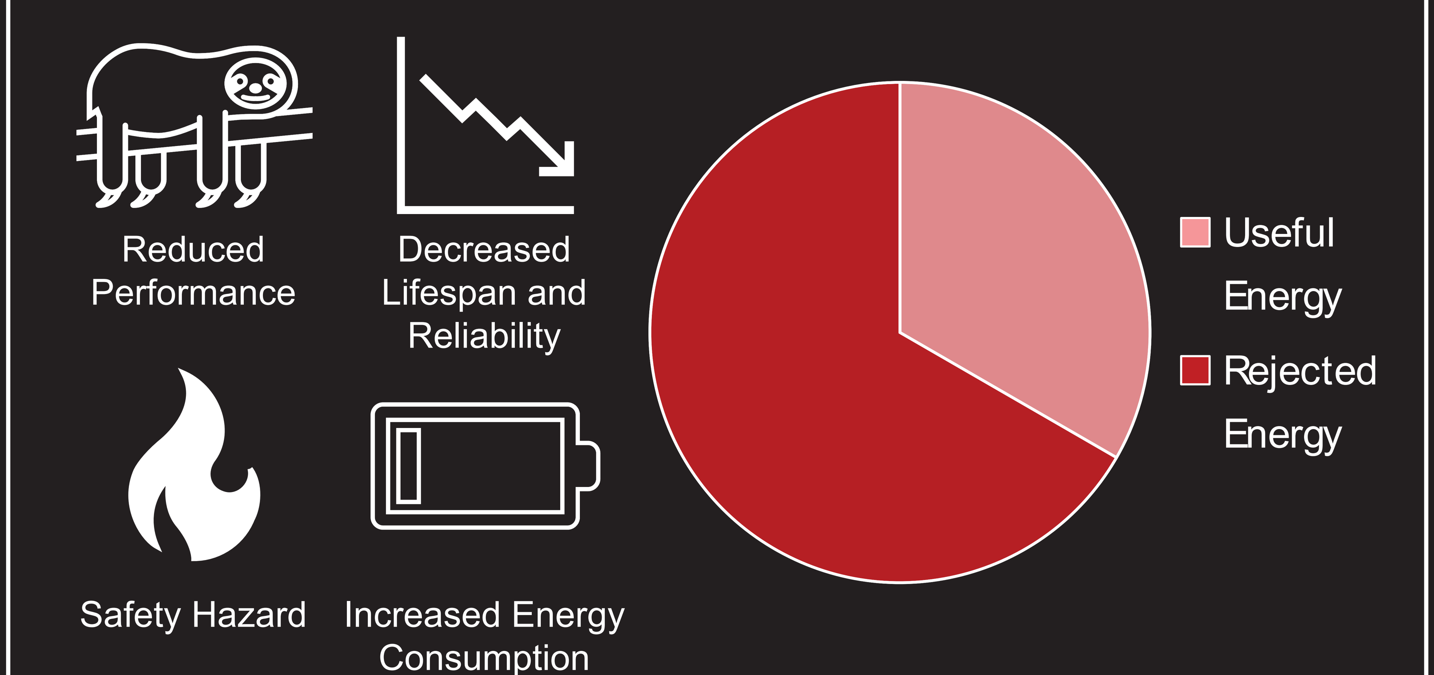
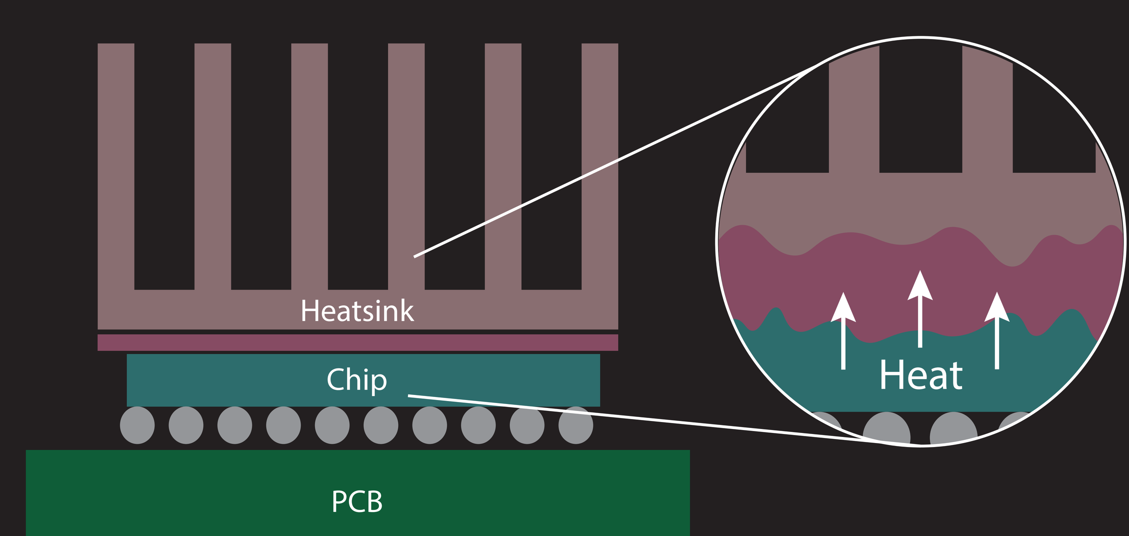
INTRODUCTION

Heat is generated in electronics during intensive tasks due to energy losses that occur as electrical components process and transfer data.

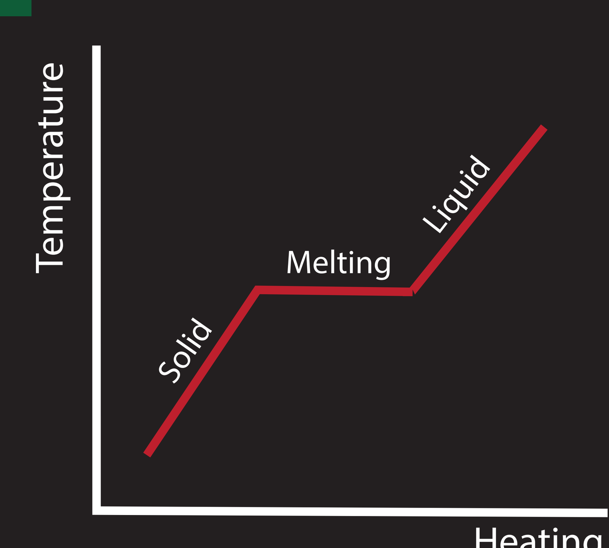


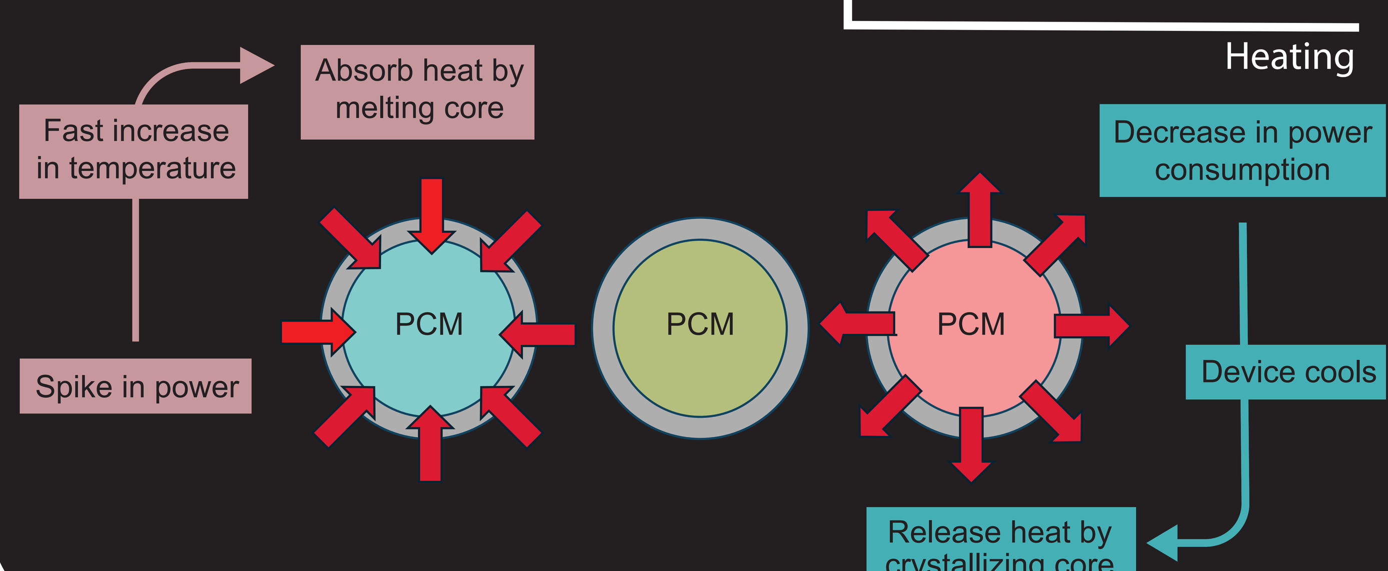
High-power energy systems face increasingly critical thermal challenges due to rapid power fluctuations and extreme environmental conditions.

Thermal interface materials (TIMs) are placed between heat-generating components and heatsinks to enhance heat transfer, but their performance is often limited under extreme thermal stress.

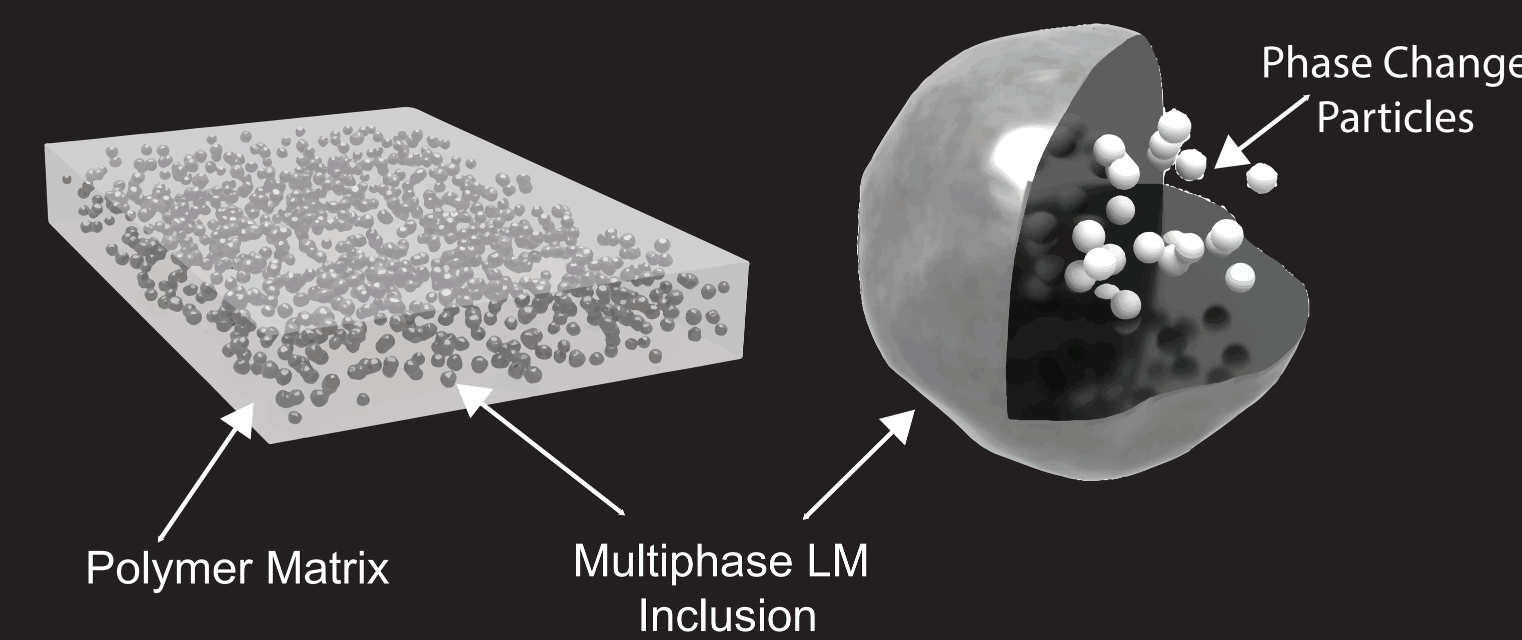


Phase change materials can passively regulate temperature by absorbing and releasing heat, but their low thermal conductivity (<0.2 W/mK) has restricted their effectiveness in demanding applications.

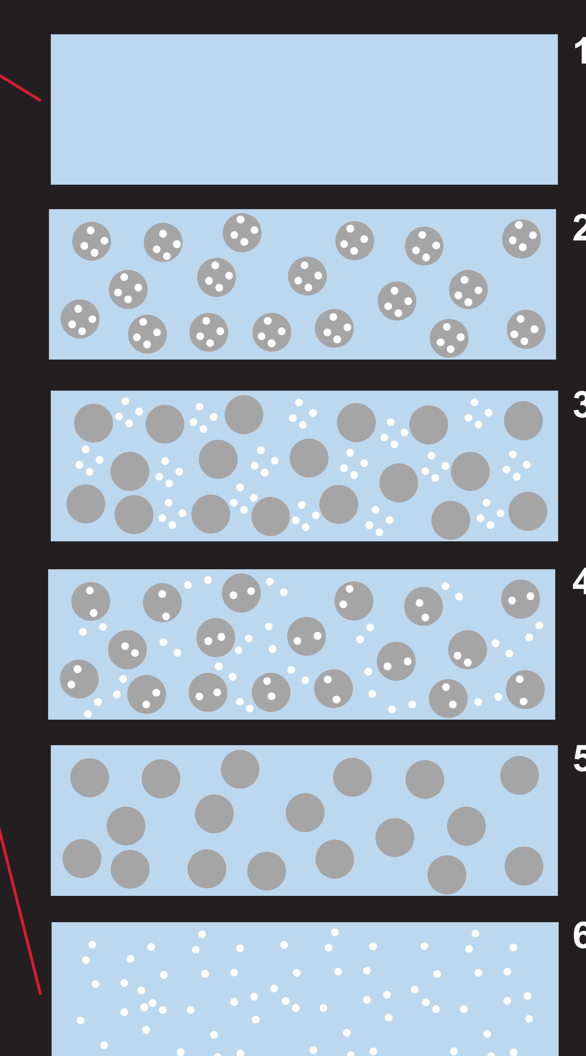




MATERIAL CHARACTERIZATION



	Sylgard 184	PEG 20K	EGaIn
1	100%	0%	0%
2	50%	12.5% in LM	37.5%
3	50%	12.5% in Sylgard	37.5%
4	50%	6.25% in Sylgard, 6.25% in LM	37.5%
5	62.5%	0%	37.5%
6	87.5%	12.5%	0%

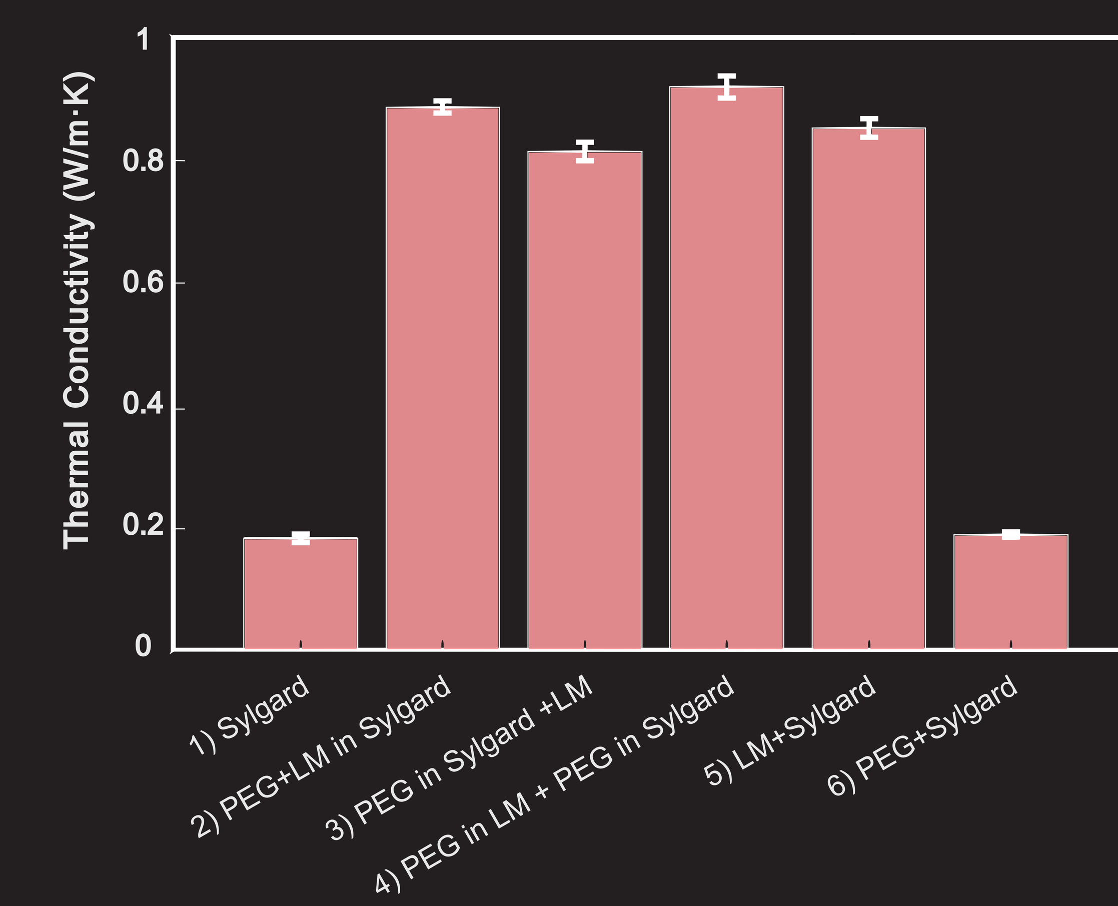


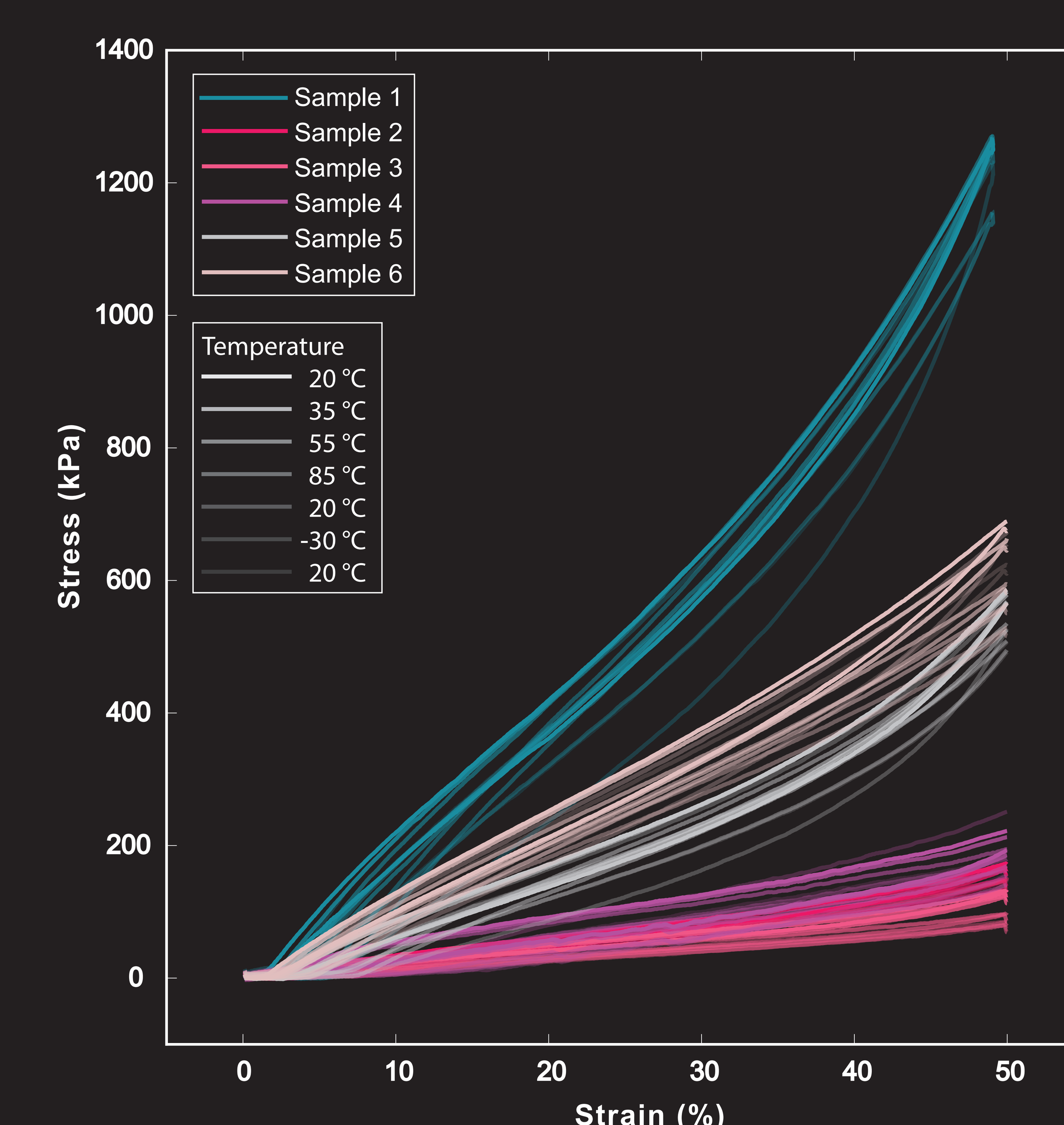
Unique combination of properties:

- High thermal conductivity
- High heat storage capacity
- Electrical isolation
- Structural integrity

Future Work

- **Model validation:** Compare thermal performance to predictive simulations.
- **Effectiveness assessment:** Evaluate heat dissipation, thermal cycling, and mechanical stability.
- **Demonstration:** Integrate material into a functional system for real-world testing.
- **PEG tuning:** Investigate effects of PEG molecular weight and size on thermal behavior.





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