The development and adoption of new materials with improved high temperature strength and thermal properties is crucial in decarbonizing carbon-intensive industries and mitigating climate change. However, the process of qualifying a new material for use in safety critical applications at high temperatures is long and expensive, often requiring decades before a new material sees industry service. This talk describes the current qualification process, focusing on high temperature structural materials used in energy generation and storage, and analyzes the current approaches to explain why qualification takes so long. The talk then surveys options for accelerating high temperature qualification, discussing options including the wider use of physics-based models, machine learning techniques, reliability-based design, and other approaches aimed at reducing the time between material discovery and when the new material sees its first applications. The discussion includes several examples drawn from work on high temperature nuclear reactors and concentrating solar power systems.

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