

**CHEMICAL THERMODYNAMIC STUDY OF ENERGY MATERIALS***Shi Quan*

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Energy materials serve as the carriers for energy conversion, storage, and utilization. In these energy-related processes, chemical thermodynamics plays an irreplaceable role in providing guiding principles for the efficient conversion and clean utilization of energy materials. Consequently, the study of the thermodynamic properties of energy materials is of great significance for the design and synthesis of advanced energy materials. In this lecture, I will discuss the recent research progress of our group in the chemical thermodynamic study of energy materials. First, I will present our work on constructing adiabatic calorimeters for thermodynamic property measurement. We designed and developed a refrigerator-cooled adiabatic calorimeter for measuring the heat capacity of condensed matters within the temperature range of 4 to 100 K. The optimized repeatability and accuracy were determined to be within 0.8% and 1.5%, respectively. Additionally, we developed an adiabatic calorimeter for thermal safety assessment and used it to study the thermal decomposition reaction of di-tert-butyl peroxide. Second, I will elaborate on the thermodynamic property studies of various energy materials, including phase change materials (PCMs), magnetic materials, and CO<sub>2</sub> adsorption materials. These studies demonstrate that heat capacity calorimetry is a powerful tool for investigating the thermodynamic properties of energy materials. Finally, I will introduce the concept of “Spatiotemporal Phase Change Materials” we proposed recently, in which the thermodynamic properties of PCMs can be regulated to achieve controllable utilization of latent heat. Based on this concept, we designed and synthesized a series of erythritol-based composite phase change materials, which show promising potential in the field of long-term thermal energy storage and controllable utilization. In summary, this lecture outlines the research work of our group in calorimetry techniques, thermodynamic property analysis and regulation of energy materials, highlighting the critical role of chemical thermodynamics in the research and practical application of energy materials.