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Combustion in Condensed Matter: New pathways for materials processing

Combustion processes in condensed matter offer a variety of approaches to prepare nanoscale materials. The self-generated heat of the process creates a localized energy supply, providing some attractive features for materials synthesis and processing. Control of structure and properties of resultant materials, however, is difficult due to the complex mechanisms of these rapid exothermic processes. Recent results allow expanding our understandings of the essential mechanistic aspects of processes and tune the structure and properties of products. In this talk, I will then give examples of specific systems, emphasizing the relations between combustion conditions, the mechanism of processes, and the structure of materials at low dimensions. I will also present recent advances in the preparation of actinide nanoscale materials, thin films, semiconductors that have high potentials for the use in advanced energy technologies. The routes to tune the magnetic, optical, and catalytic properties of materials will also be highlighted.