SYNTHESIS OF ORDERED NANOENERGETIC COMPOSITES

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ABSTRACT

Energetic materials can be defined as the substances or mixtures that react chemically to release energy required for their intended application. Thermite is a subgroup of pyrotechnic, a class of energetic material. Conventionally thermite materials are synthesized either by physical mixing of solid oxidizers and fuels on a macro scale (also known as energetic composite) or creating a monomolecular energetic material, in which each molecule contains an oxidizing and a fuel component. For the energetic composites, the total energy that can be released after combustion can be much greater than that of monomolecular materials. However, for the composites the burn rate is relatively slow when compared to that of monomolecular materials. It is known that the energy release and the burn rate can be significantly different in nanostructured materials (1 to 100 nm) called as nanoenergetics. A new approach to synthesize nanoenergetic materials is developed using the sol-gel chemistry. In the present sol-gel approach to synthesize energetic composite, fuel nanoparticles are added just before the gelation of oxidizer. This may adversely affect the interfacial area for the energetic reaction which may result in the lower energy release and burn rates. To address this issue the main focus of this thesis is to create uniform pores and their distribution using templating agent during sol-gel synthesis of oxidizer and subsequent impregnation of fuel. This will result in homogeneous nanoporous oxidizer network with high interfacial area for energetic reaction and will thus improve the energy release and burn rates.