Synthesis and Processing of Thermite Reactions

Thermite reactions can now release more energy quicker for greater propulsion and more powerful explosions with a process for preparing composite thermite particles developed at UCF. The thermite composition can be used in propellant and explosive devices permitting significantly better control of the ignition and propagation phases of the thermite reaction.

Thermite is a type of pyrotechnic composition of a metal and a metal oxide, which produces a highly exothermic reaction, known as a thermite reaction when ignited by heat. Unlike known techniques for forming thermite compositions, the inventors have created a process that enables the shearing of the thermite components without any significant initiation of the thermite reaction. Quickly conducting low temperature milling avoids atomic level mixing of the starting materials. As a result, the stored total energy of the resulting particles is increased as compared to conventionally milled thermite compositions, and the speed of energy release can be increased.

Technical Details

Developed in the early 1960s, the reagents for thermite reactions are both solid materials, metal and metal oxide, which do not readily permit mixing and require substantial preheating. This innovation presents a process for the preparation of composite thermite particles from a plurality of pressed composite particles that form a convoluted lamellar structure with alternating layers of metal and metal oxide. The procedure includes introducing metal oxides and complementary metals capable of reducing the metal oxide. The materials are then milled at a cryogenic temperature (i.e., below −50° C) to form a convoluted lamellar structure. The average layer thickness is generally between 10 nm and 1 μm and the molar proportions of the metal oxide and metal are generally within 30% of being stoichiometric for a thermite reaction.

Benefits

• Greater stored energy in the thermite particles
• Increased energy release
• Better propagation of the thermite reaction

Applications

• Industrial repairs
• Thermite charges and explosives
• Aerospace, military, and civil

Additional Technology Numbers: 30847, 31599

Technology #32614


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