TECHNOLOGY

Low Temperature Synthesis of Faceted Aluminum Nanocrystals

OVERVIEW

Metal/oxidizer combinations make very powerful energetic materials due to their high total energy content compared to CHNO-based materials. Bulk aluminum has a very high energy density when oxidized to alumina, but problems arise for energetic applications because the kinetics are diffusion limited between oxidizer and aluminum. This is partially mitigated by reducing the particle size and therefore increasing the surface area-to-volume ratio.

Current methods of producing aluminum nanoparticles rely on high temperature vaporization into an inert quenching gas, such as DC-arc discharge, laser ablation, commercial air atomization (CAA), and commercial inert gas atomization (CIGA), which all produce similar polycrystalline particles less than ~50nm in diameter that are highly aggregated.

University of Maryland and Naval Surface Warfare Center researchers have developed a low temperature route for decomposition of aluminum compounds in solution. By utilizing an aluminum precursor with a decomposition temperature below the melting point of aluminum, more control is exhibited over the nucleation and growth of nanoaluminum. This process is capable of producing aluminum nanoparticles with no oxide layer, significantly improving its use in energetic applications.

Applications:
• Propellants - solid rocket motors
• Pyrotechnics
• Explosives

Advantages:
• Low temperature production – slow crystal growth
• Continuous flow production in an aerosol process
• No oxide layer allows for passivation or reactive coating

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Additional Information

INSTITUTION

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PATENT STATUS

Patent(s) pending

LICENSE STATUS

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CATEGORIES

- Nanotechnology + Nanoparticles + Nanomaterials

EXTERNAL RESOURCES

- US Patent 9,492,870

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