

SOLUTION COMBUSTION SYNTHESIS OF METAL NANOPOWDERS

PART 1: NICKEL- REACTION PATHWAYS

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University of Notre Dame, IN-46556***Abstract**

Nanopowders of pure nickel were directly synthesized for the first time by conventional solution combustion synthesis (SCS) method. In part 1, a specific reaction pathway is suggested to describe the metal's phase formation during SCS. It is proposed that the exothermic reaction between NH_3 and HNO_3 species formed during the decomposition of glycine and nickel nitrate, act as the source of energy required to achieve the self-sustained reaction regime. A thermodynamic analysis of the combustion synthesis reaction indicates that increasing glycine concentration leads to establishing a hydrogen rich reducing environment in the combustion wave that in turn results in the formation of pure metals and metal alloys. TGA of reaction systems and XRD analysis of products in the quenched combustion wave show that the formation of oxide phases occurs in the reaction front, followed by gradual reduction of oxide to pure metallic phases in the post-combustion zone. A methodology for solution combustion synthesis of pure metals and metal alloys nanoparticles can be inferred from the results presented.

Key words: combustion synthesis, nanocrystalline materials, metal & alloys, phase transformations

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