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INVESTIGATION IN THERMAL DECOMPOSITION OF PRECURSORS

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Investigation in Thermal Decomposition of Precursors

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ABSTRACT

Advances in high performance materials for structural and thermal applications will increasingly depend on our ability to control the size, distribution and morphology of their constituent phases at the sub-micrometer or manometer level. Since capabilities for synthesizing such nanophase materials are becoming available, it is now possible to produce the quantities of materials needed for prototype development and testing.

Chemical processing of materials (i.e. the synthesis of precursor powders from molecular precursor compounds by spray drying) and the subsequent thermochemical conversion of the precursor powders to amorphous or nanophase microstructures has become a vital component in the economic development of advanced engineered materials. It is a much more direct route for making materials than traditional processing methods and permits lower cost manufacture of novel materials with homogeneous ultrafine (amorphous and nanophase) microstructures in conjunction with improved properties.

Thermochemical processing is a new technology for making amorphous and nanophase composite powders. The present work explores new opportunities for exploiting this technology for a range of powders with diverse compositions and applications. The ultimate goal will be the synthesis of clean powders and the manufacture of flaw-free amorphous and nanophase coatings and net-shaped parts.

The present work will exploit our collective knowledge and experience in the processing of amorphous and nanophase composite powders. The

novel but integrated approach which is to be followed involves three coordinated steps:

1. Preparation and mixing of starting solutions of the chemical precursor compounds to fix the composition of the starting solution.
2. Rapid spray drying of the starting solution to form chemically homogeneous spherical precursor particles.
3. Fixed or fluid bed thermochemical conversion of the precursor powder into the desired amorphous or nanophase powder by controlled gas-solid reactions.

All three steps in the process can be readily scaled up. This approach will lay the foundation for a new integrated manufacturing technology for the production and utilization of nanophase composite powders. It is anticipated that the integration of these inherently scalable and proven processing steps will yield higher performance powders at lower manufacturing cost.

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