

EFFECT OF GRAVITY ON THE COMBUSTION SYNTHESIS OF ENGINEERED, ADVANCED MATERIALS

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Combustion synthesis (self-propagating, high temperature synthesis-SHS) is currently being used at the Colorado School of Mines to produce a wide range of engineered composite materials. These engineered materials include ceramic, intermetallic, and metal-matrix composites that can be produced for applications that range from structural and oxidation and wear resistant materials, e.g., TiC-SiC, TiC-Cr₃C₂, MoSi₂-SiC, NiAl-TiB₂, to engineered porous composites for biomedical materials, e.g., B₄C-Al₂O₃, Ti-TiB_x, Ni-Ti, Ca₃(PO₄)₂ and glass ceramic composites.

The control parameters of a combustion synthesis reaction include green density, reaction stoichiometry, mode of combustion and heating rate, and reactant particle size, and gravity. The paper will explain how the reaction parameters and the underlying physical chemistry of the combustion synthesis reactions may be controlled to produce the composite material in the required chemical composition, density/porosity, microstructure and properties.

Data will be presented of recent experiments conducted on the synthesis of engineered, advanced materials in the NASA parabolic flight (KC-135 aircraft) facilities, and on the role that gravity plays in controlling the structure and properties of these materials.