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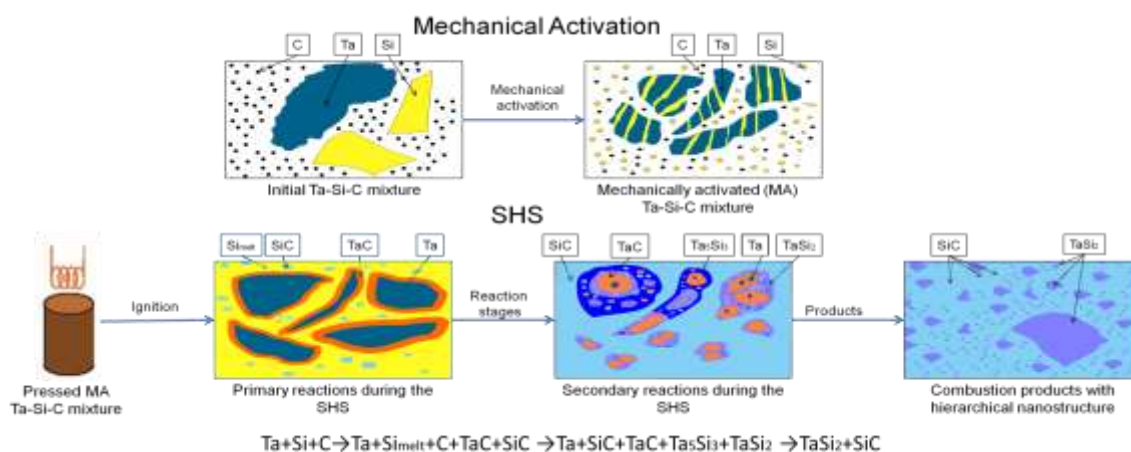
# Self-Propagating High-Temperature Synthesis of Nanocomposite Ceramics TaSi<sub>2</sub>-SiC with Hierarchical Structure and Superior Properties

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Graphical abstract



## Abstract

This study focuses on the investigation of the combustion kinetics and mechanisms, as well as the phase and structure formation processes, during elemental self-propagating high temperature synthesis of ceramics in Ta-Si-C system.

Thermodynamic and kinetic features of SHS are discussed. Thermodynamic calculations, time-resolved XRD and investigation of stopped combustion front suggest the following chemical reactions sequence in combustion wave for the Ta-Si-C system:  $\text{Ta} + \text{Si}_{\text{solid}} + \text{C} \rightarrow \text{TaC} + \text{Si}_{\text{solid}} + \text{C} \rightarrow \text{TaC} + \text{SiC} + \text{Si}_{\text{liquid}} + \text{C} \rightarrow \text{TaC} + \text{TaSi}_2 + \text{Ta}_5\text{Si}_3 + \text{SiC} + \text{Si}_{\text{solid}} + \text{C} \rightarrow \text{TaSi}_2 + \text{SiC}$ .

Significant microstructure refinement occurs due to the formation of SiC within the TaC, Ta<sub>5</sub>Si<sub>3</sub> and TaSi<sub>2</sub> particles during the SHS. Combustion products consist of agglomerated SiC and TaSi<sub>2</sub> particles with the size of individual grains equal to 15-50 nm. Hot pressing of TaSi<sub>2</sub>-SiC powders at 1600°C produces the bulk

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