

Abstract:

Supersolidus liquid phase sintering (SLPS) is a variant of liquid phase sintering. In SLPS, prealloyed powders are heated between the solidus and liquidus temperature of the alloy. Liquid forms along the grain boundaries within the particles, fragmenting them into individual grains. The semisolid compact densifies in response to the capillary force exerted by the liquid film along the grain boundaries. The rheological response of the compact during sintering determines the densification and distortion response. Above the solidus temperature the liquid formation decreases the apparent viscosity of the compact. The compact densifies when the sintering stress is higher than the inherent strength of the compact. If the viscosity drops too low, distortion happens in response to gravitational forces. Hence, there exists a critical viscosity window in which full density is achieved with minimal distortion. SLPS is an important processing route for stainless and tool steels. Stainless steel 316L is an important class of steel which combines high strength to weight ratio, corrosion resistance, impact resistance along with its aesthetic appearance. My work focuses on processing of stainless steel 316L via SLPS by adding boron as sintering aid. The crux of this work is to understand the evolution of apparent viscosity and its relation to the microstructure. The densification behavior was modelled using Master Sintering Curve (MSC) concepts. The optimization of mechanical and corrosion properties by boron additions is evaluated for producing parts with optimum properties.

Processing, properties and microstructure of diamond composites for thermal management applications.

Thermal management is a critical issue in high-power laser diode and LED packages, and microprocessor units. Reliability and long life time of electronic packages ask not only for materials with high thermal conductivity but also a coefficient of thermal expansion (CTE) matching to that of semiconductor materials. The thermal expansion of the heat sink material in electronic packaging should be compatible with that of the semiconductor, i.e CTE between 4-7 ppm/K. The CTE can be tailored for a specific application by using a reinforcement material with lower thermal expansion and by varying the volume fractions of the constituents. Among all the reinforcements, diamonds are attractive as they have superior thermal conductivity (1000-1500 W/m.K for commercially available industrial diamonds) and a low CTE (2-3 ppm/K) and the ever decreasing prices encouraging a sooner market realization. This talk intends to present the processing, thermal properties, microstructure, thermal reliability, environmental stability of diamond composites and the feasibility of integrating these composites into an electronic package.