Ceramics have many important applications, but they often have relatively low fracture toughness, which can limit or negatively affect their applications. An invention from the University of Central Florida and Illinois Institute of Technology is a new process that creates carbon nanotube (CNT) – non-oxide structural ceramic nanocomposites through the laser sintering of a mixture of CNTs and non-oxide structural ceramic powders (e.g., carbide, nitride, or boride), compared to the currently available processes such as hot pressing or thermal spraying. This novel technique provides improved hardness and fracture toughness to ceramic nanocomposites. This technology can potentially produce ceramic nanocomposite surface coatings with little thermal damage—difficult to achieve with hot pressing. This process can be used on critical mechanical parts that are subjected to harsh environments, which need enhanced surface wear or corrosion resistance, such as turbine blades, pump shafts, hydraulic piston and connecting rods, automobile brake pads, etc.

**Technical Details**

This novel process involves placing the mixture in an inert atmosphere during laser sintering, which occurs in a chamber, to avoid a reaction of the mixture with the ambient atmosphere and undesirably absorbing or scattering the laser beam’s energy. The chamber, comprised of a gas application shield which permits the transmission of a laser beam without significant alteration, is equipped with at least one flow system and a filtration system to permit at least one periodic gas medium flow, continuous gas medium flow, periodic gas medium filtration, and continuous gas medium filtration. A quantity of CNTs is combined with a non-oxide structural ceramic powder, comprised of chromium carbide (CrC2), boron carbide (B4C), or molybdenum carbide (Mo2C), to form a mixture, and is then laser sintered to form a CNT – non-oxide structural ceramic nanocomposite.

**Benefits**

- Strengthens ceramic nanocomposites
- Minimizes thermal damage when applied to substrates

**Applications**

- Advanced ceramics
  - Aerospace
  - Defense
- Mechanical parts

**Technology #33316**

- US Patent Pending

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