

Patent on Alumina composites from Professor V. Seshu Bai's research group

Title : METHOD FOR PREPARING CERAMIC COMPONENTS COMPRISING ALPHA ALUMINA PLATELETS

has been granted.

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Description of the Patent:

Ceramic composites based on alumina, with improvement in fracture toughness up to 80% in comparison with pure alumina parts, is claimed in the patent. In the invention, the alumina parts are reinforced with alpha-alumina platelets of nanometric thickness (~ 150 nm) after uniformly coating them with LaPO_4 on their surfaces. The coatings help promote crack deflection and energy dissipation in the composite during mechanical loading. Optimized compositions with ~ 4 wt% alpha-alumina platelets were observed to give up to 80 % enhancement in fracture toughness (up to $\sim 5.4 \text{ MPa}\sqrt{\text{m}}$), while retaining the good flexural strength levels of ~ 300 MPa available in pure alumina parts. Since the alpha-alumina used as reinforcement, is the most stable form of alumina, the parts made out of the present composite can be used up to the usual high operating temperatures of pure alumina parts (around 1600°C to 1750°C); this is unlike in the alumina matrix composites reinforced with alumina fibres, which deteriorate in properties above 1150°C due to structural transformations. The method of fabrication, which also is claimed, involves the setting of a highly concentrated slurry of the starting materials in a mould of the required shape. The mould is prepared by additive or subtractive manufacturing. The mould is removed by a suitable method and the component is dried, the binders are removed and the part is sintered. This method of fabrication enables the production of complex-shaped parts with uniform microstructures. The patent reports a technical advancement in the fabrication of alumina components that are widely used as thermal insulators, dental implants and as high temperature components in aerospace and automobile applications.