

Silicon nitride ceramic substrates for chip substrate applications

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Abstract: The lecture will give a comprehensive view on innovative developments made in the field of nanocarbons e.g. carbon black, carbon nanotubes (CNTs), graphene added ceramics highlighting the key issues related to integration technology and improvements in the mechanical, tribological or functional properties as a result. Among non-oxide ceramics the silicon nitride based ceramics are well-known as lowdensity materials with high strength and toughness. Silicon nitride, known as a typical dielectric material, is an ideal candidate for several structural applications, even at high temperatures. The addition of graphene or carbon nanotubes to silicon nitride to create ceramic nanocomposites gives rise to promising applications in a wide range of fields such as electronics, biomedical aids, membranes, flexible wearable sensors and actuators, energy systems. It is wellknown that silicon nitride ceramic substrate has excellent insulation performance and good heat dissipation, therefore can be used to manufacture various high-power electrical components, such as power modules, heating modules, etc., effectively ensuring the service life and reliability of electrical equipment. The presentation will show how the use of different reinforcing phases, their dispersion grade, ceramic matrix – CNTs, graphene interphases and sintering methods influence the microstructure and as a result, mechanical properties, electrical, thermal conductivity and tribological properties of the final silicon nitride nanocomposites. The prospective future applications will be also discussed.

Keywords: silicon nitride, carbon nanotube, graphene, substrates