Christophe Laurent, J Nanomater Mol Nanotechnol 2017, 6:7(Suppl)
DOI: 10.4172/2324-8777-C1-016

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Graphene-ceramic nanocomposites

Graphene-ceramic composites are focusing worldwide attention because they allow to combine some very attractive electrical, thermal and mechanical properties. Among the matrices investigated are Si_3N_4, TaC, Al_2O_3, ZrO_2-toughened Al_2O_3, MgO, hydroxyapatite and SiO_2, the latter mainly as film. It is acknowledged that one of the main challenges of the field is to develop processing routes ensuring homogeneous dispersion of graphene in the ceramic matrix, without inducing contamination and introducing undesirable structural defects. These routes will be reviewed. Consolidation is performed by several techniques including hot isostatic pressing (HIP) and spark plasma sintering (SPS). One key feature is that the graphene-induced grain-size refinement of the matrix is to be taken into account when discussing the properties. Results on the electrical, thermal and mechanical properties will be discussed. The proposed mechanical reinforment and toughning mechanisms, such as graphene pullout, crack bridging, crack deflection and crack branching will be presented. When appropriate, a parallel with carbon nanotube-ceramic composites will be made.

Biography

Ch Laurent is a Full Professor of Materials Chemistry at Toulouse University (Université Paul-Sabatier), currently Director of CIRIMAT, the Interuniversity Center for Materials Research and Engineering, and former head (1998-2015) of its Nanocomposites and Carbon Nanotubes team. He got his BSc and MSc in Chemistry, and Doctor in Materials Sciences degree (PhD) at Toulouse University. Currently his researches focus on the synthesis of carbon nanotubes and graphene (notably the selectivity on the number of walls/layers), ceramic- and metal-matrix nanocomposites and spark plasma sintering. He has published more than 110 papers in peer-reviewed journals.

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