Advanced Colloidal Processing for Preparation of Nano-Composites by Spin Coating Process

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ABSTRACT

The aim of the present work was to identify a systematic and investigation on the influence of processing conditions (dispersant stabilizing mechanism and solid loading, particle size and particle size distribution, temperature and sintering aid addition-yttria) on colloidal processing of alumina toughened zirconia (ATZ) nano-composites was conducted.
Rheology was the main tool used to evaluate and control the correct processing of the powders.The investigation was rather comprehensive, accounting for all processing steps from suspension preparation, consolidation, drying and sintering.The ultimate goal was to establish a correct methodology to process of alumina and tetragonal stabilized zirconia-doped-3mol.%yttria and mixture of ATZ powders with advanced colloidal techniques for the preparation and optimization of high stable slurries with high solids content up to 77 wt.% for production of nano composites objects with improved properties and to establish as clearly as possible relationships between processing and microstructures, i.e. how processing controls or modifies the microstructure.Different type of polyelectrolyte dispersants have been used which just an organic deflocculating agent (DOLAPIX CE 64, Zschimmer & Schwarz, Germany) that is free from alkali, completely dissociated in suspension immediately and with better effect by high stability, homogeneous incorporation with lower viscosity into the slip. Stability of suspensions prepared by planetary ballmill(Pulverisette 6, Fritsch, Germany).Rheological properties of suspensions was characterized by rotational viscometry (Haake Viscometer, RV1, Germany) for shear rates between 0 and 1000s^{-1}. An elector-acoustic technique called: “Electrokinetic Sonic Amplitude (ESA)” applied for characterization of the dispersing behaviour of high solid concentrated (77wt.,%) suspensions in double distilled water with or without the adding of an anionic polyelectrolyte as disperant.
One of the main advantages of this investigation is easy handling and shaping by variety of forming techniques like as (tape-casting, slip casting,…) meanly in this present work by spin coating. Shaping method which discussed in this work was especially spin coating technique for preparing wafer flat surface coated substrates for the different nano technology industrial applications.
The results of this work present the necessary basis for the development of new type of nano-materials applied for nano-technological applications which from especially such as apply for the compositional gradient composites that combine e.g. the advantages of the high wear resistance of alumina and the high fracture toughness of zirconia.
In the future, the prediction of this investigation can be apply for a new type of composite materials in nano-scale sizes of microstructure which will be design according to especial properties of nano-sized particles meanly in the following two fields as: I) a new generation of Functionally Gradient Materials (FGMs), with a tough zirconia core and a wear resistance alumina surface and a layer structure with gradually (stepwise or continuously) changing composition in between to reduce

thermal expansion mismatch and internal stresses and to avoid interlayer cracking, possibly in the form of nano-composites, and ii) a new type of the Smart Microstructural Electrical Devices (SMEDC), could be developed and acquire a niche on the nano-materials markets.
In this present paper will be discuss an overview to spin coating technique and its the simplest analysis of the key elements of spin coating concerns the spin coating of a nonvolatile Newtonian fluid.**.** After numerous assumptions, the equation of motion reduces simply to illustrate the balance of viscous and centrifugal forces. Also some technologies that depend heavily on high quality spin coated layers are mentioned.Reviewed some important Key Stages in Spin Coating process.
Keywords: Colloidal processing; Rheology; viscosity; high solid content; Elecroacoustic (ESA); Alumina Toughened Ziconia; Spin Coating.

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