Industrial production of tailored nanoparticles by advanced, high-output, high-versatility Flame Spray Pyrolysis

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Flame Spray Pyrolysis (FSP) nanoparticle production technology designed and constructed by Lurederra is suitable to achieve at a continuous and trouble-free production level of 5kg/h, obtaining the same results regarding nature and size range (10-20 nm) of nanoparticles as in small FSP laboratory reactors. Therefore, validating the technology developed for the production in industrial operating conditions of a wide diversity of high-quality nanoparticles such as simple and complex (mixed, doped, core-shell) nano-oxides for multi-sectorial applications such as automotive and energy catalysts, cosmetics and dental fillers, medicine and nutrition, phosphors, pigments/paints, sensors for gas detection, specific radiation filters, magnetic materials, conductive additives, photo-catalysis or lighting among many others.

In FSP nanoparticle synthesis, liquid precursors with specific proportions of the metals to be pyrolysed dissolved in a fuel or solvent are dispersed through a nozzle. The resulting spray is ignited and sustained by a pilot flame. Pure powder particles are produced within the spray flame, with aerosol formation, droplet evaporation, combustion, coagulation, sintering and even surface growth occurring in parallel.
Main strengths of this technology are:

- Industrial production capacity up to 5 kg/h of nanoparticles (largest in the world)
- Fully automated and closed production line from feeding system to collection of nanoparticles
- Great versatility in the nature of the nanoparticles: simple oxides, mixed and multicomponent oxides, doping, phosphates, carbonates…
- Monitoring and control of the process for high performance nanoparticles: size, crystallinity, purity.

Precisely, for a specific application related to the development of transparent conductive coatings, novel Indium-free complex compositions of nanoparticles have been produced at different scales validating their printability when formulated as inks. Moreover, in the characterisation carried out to the cost-effective nanoparticles of AZO (Aluminium and Zinc mixed oxide), Si/Zn (Si doped ZnO) and Nb/Ti (Nb doped TiO_2) produced, it was concluded that, the proportions defined in the liquid precursors where the same in the final mixed nanoparticles obtained; and also, no structures of simple oxides were observed by XRD, so it was confirmed the development of novel crystal phases with the corresponding insertion of the dopants into the main lattices.

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