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DEPOSITION OF AMINOSILANE COATINGS ON POROUS Al2O3 MICROSPHERES BY ATMOSPHERIC DIELECTRIC BARRIER DISCHARGES

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The objective of this work is the development of an atmospheric dielectric barrier discharge (DBD) process, aimed at the surface functionalization of porous alumina microspheres with an organosilane precursor. Functionalized alumina particles are employed for a variety of applications, e.g. biomolecules immobilization, chromatography or sorbent material. In this work, monodisperse alumina microspheres (600 µm) were produced by vibrational droplet coagulation technique and sintered at different temperatures, obtaining particles with different porosity levels. Plasma surface modification was performed in a parallel plate DBD atmospheric plasma chamber with movable upper electrodes and a grounded electrode designed as a vacuum table, to hold a monolayer of powders in place during the treatment. The 3-aminopropyltriethoxysilane (APTES) has been chosen as precursor, in order to add active amine and siloxane groups, and N_2 as carrier gas. The precursor was injected into the reactor as an aerosol, by means of a nitrogen fed atomizer. The effect of the treatment time was studied in terms of passes of the moving electrode over the sample. The obtained results of FT-IR, XPS and SEM-EDX analyses demonstrate that plasma processing of Al_2O_3 microspheres leads to a clear modification of the surface. Focused Ion Beam was used to prepare a lamellar cross section of the microspheres embedded in a resin. Next, this sample was investigated by STEM-EDX. This technique shows that the particles are uniformly coated with a nm-thick layer of aminosilane, using an adequate number of passes, and the effective penetration depth of the coating inside the pores can be efficiently evaluated. In view of up-scaling the process, a dynamic semi-continuous treatment of powders has been also used, with preliminary encouraging results.

Keywords
Powders functionalization
Atmospheric plasma
DBD
Alumina porous microspheres