

Plasma deposition of coatings with oxygen containing functionalities on alumina microparticles

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Ceramic oxide particles (e.g., Al₂O₃ and SiO₂) are considered suitable for a lot of applications thanks to their favourable properties such as high surface area, robustness, chemical/thermal stability and low cost [1]. However the utilization in several fields depends on their surface properties, therefore the surface functionalization of these materials with appropriate chemical groups is often necessary [2]. For this purpose, the development of versatile and simple approaches has been required and low and atmospheric pressure cold plasma processes by mean of ad hoc reactors can be considered very interesting. Indeed, they are flexible, dry, solvent-less, environmentally friendly and not affect bulk properties of the substrates [3].

This work focuses on the surface functionalization of alumina micrometric particles with oxygen containing (O-containing) coatings using a home-made and very easy to realize low pressure (LP) rotating plasma reactor. Firstly plasma processes, which consist of a first deposition step with CO₂/C₂H₄ mixtures followed, or not, by a second treatment step in CO₂ and/or H₂, were developed on flat substrates. Experimental results showed that during the first step, at lower power values, the presence of CO₂ in the gas feed increases the concentration of oxygenated functionalities. A further increase of O-containing groups, including COOH, was obtained with the second step, more evident in CO₂ pure discharge. Secondly, the best thin films obtained were applied to modify the surface of Al₂O₃ microparticles kept in gentle agitation in the rotating LP reactor. In this way, the homogeneous surface functionalization of the microparticles was performed and a potential application could be the heavy metal ions removal from water.

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