

Surface treatment of coarse Y_2O_3 ceramic powders by a microwave plasma torch: Their mobility improvement and densification

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In a ceramic powder coating processing, the coarse surface and the pores of small size ceramic powders ($<25\mu\text{m}$) are caused to porosity generation problems of coating layer and non-quantitative feeding rate. These issues are recovered by a thermal sintering technique. In this regard, a microwave plasma torch is applied to improve mobility and densification of ceramic powders. The microwave plasma treatment is carried out by suitable reaction conditions, showing both high density and mobility of ceramic powders. The Y_2O_3 ceramic powders (Shin-Etsu chemical) were treated by the microwave plasma torch. The ceramic powders were modified by active species in high temperature plasma flame of 6000K at atmospheric pressure. Eventually, the coarse surface on the ceramic powder was modified instantaneously by high chemical reactivity in the plasma, revealing a smooth surface, functionalization on surface. The treated small ceramic powders lubricate between coarse powders to improve mobility. In addition, the ceramic powder is polarized on the surface due to the high chemical reactivity of the plasma, so that the ceramic powders have a high repulsive force. In this test, the densification and the mobility strongly depend on the applied plasma power and feeding gas ratio of N_2/O_2 at a fixed powder feeding rate. The experimental results show that the microwave torch plasma will be attractive for a sintering process, which is necessary for short treatment time and high heat flux.

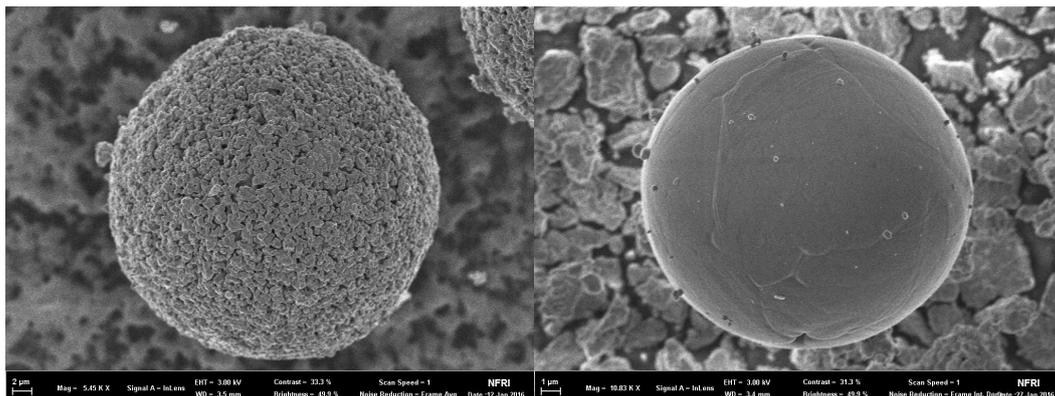


Figure 1. The Y_2O_3 powder images of before and after treated by microwave plasma torch.

References:

1. Rachman, C., Amit, S., Claude, E. (2009) Densification of nanocrystalline Y_2O_3 ceramic powder by spark plasma sintering, *Journal of the European Ceramic Society.*, 29, 91-98.