Dense Yttria Film Deposited on a Plasma-Sprayed Al_2O_3 Coating by Aerosol Deposition

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- The aim is to select the conditions for obtaining good adhesion on the surface of aluminum oxide, to protect it from the plasma.

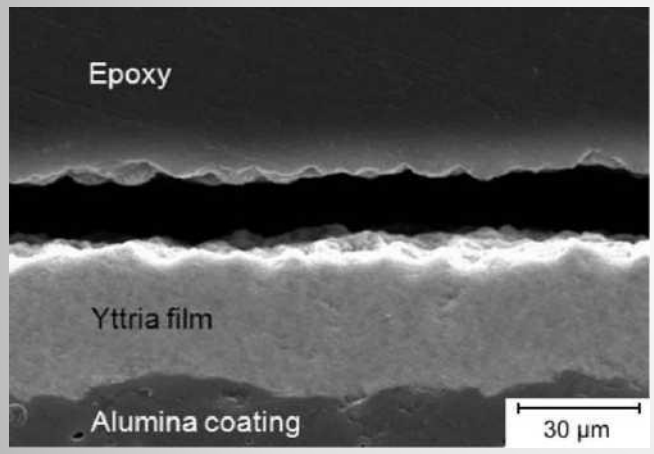
Keywords: Yttria film, alumina, surface roughness, grit blasting, aerosol deposition

- **Introduction**
- Chamber parts of semiconductor processing and flat- panel-display processing equipment often need electrical insulation and chemical protection. Sintered ceramics including alumina, aluminum nitride and others have been used for such parts owing to their excellent electrical property and chemical stability.

- However, recent progress requires scale-up of the production equipment and the chamber parts. This becomes more difficult, expensive and time-consuming as the size of part to be sintered is increased. For making some of the large parts, ceramic coating might be an alternative.

- **Methodology**
- the substrate was fixed onto a motored stage using double-sided tape in the deposition chamber, which was evacuated by a rotary pump with mechanical booster pump. The substrate surface was positioned 10 mm away from the nozzle and reciprocally moved 15 times at 10 mm/s.

- Yttria particles were sprayed onto 20 mm x 20 mm surface of the alumina through a nozzle with slit-type opening of 0.8 mm x 35 mm in the deposition chamber.



SEM micrograph of sample 3; high magnification showing the alumina coating and yttria film.

- Result
- In this study, the optimum average surface roughness (Ra) value was between 0.5 im and 1.8 im. Aerosol deposition of dense yttria film improved the CF_4 + Ar plasma erosion resistance of the porous plasma-sprayed alumina coating by about eight times.

- Conclusion
- important for the plasma-sprayed alumina coating to have a microscopically rough surface for deposition of the yttria film. The microscopically rough surface provided a large contact area at the interface and strong adhesion between the alumina and yttria film that allowed deposition of the thick and dense yttria film. The dense yttria film deposited by means of aerosol deposition remarkably improved the erosion resistance to CF4 + Ar plasma of the porous plasma-sprayed Al_2O_3 coating.