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Masked Alumina-Titania Spot Spraying Bead Formation and Characteristics in Atmospheric Plasma Spraying

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Abstract

Alumina-titania composite particles were overlaid by allowing the particles to be deposited for a short time without moving a plasmatron[spot spraying bead]. Both the deposition efficiency and maximum thickening rate were measured. By dividing the maximum thickening rate by the deposition efficiency, the particle segregation with a cross section of a mass flux within a plasma jet could be estimated. There were inhomogeneities in phase composition and splat morphology at each position within a spot spraying bead. Particle melting state according to the position within a mass flux at the moment of impact could be estimated. As the radial distance from the center region to the peripheries, the number density of unmelted particle was increased. And also, the satellite particle population was also increased with the radial distance. Comparing the aspect ratio of the feedstock with that of the unmelted particle within a spot spraying bead, these unmelted particles came from the partially melted particle. And the least melting fraction was estimated.

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Plasma Sprayed Al_2O_3-YAG Composite Coatings for Microelectronic Applications

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Abstract

Microelectronic device processing involves a reactive ion etching in plasma chamber where erosion and corrosion attacks not only the wafer/glass but also chamber components. Ceramic oxide coatings are used for the protection of metallic and ceramic components in order to extend component life and to reduce contamination. In this study, Al_2O_3-YAG composite coating has been manufactured by plasma spraying using in-house synthesized nanocomposite feedstock powder. Unlike a typical splatted lamellae characteristic in thermal sprayed coatings, the plasma sprayed Al_2O_3-YAG coating consisted of almost featureless and amorphous microstructure, with no formation of a discrete splat boundary. Subsequent heat treatment above 1000^oC led to the precipitation of Al_2O_3 and YAG crystalline phases, the sizes of which were controlled by heat treatment temperatures. The crystallization of Al_2O_3/YAG nanocomposite resulted in a significant increase in hardness up to 1200Hv, compared to 700-800Hv for the amorphous coating. Corrosion/erosion resistance of the coatings was evaluated using an inductively couple plasma with F-containing gases. The degree of crystallinity and the size of constituent phases significantly affect the plasma-induced damage behavior of the Al_2O_3-YAG composite coatings.
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