Microstructure and Phases Analysis for Advanced Plasma Sprayed Zirconia-Ceria-Yttria Thermal Barrier Coating

Abstract—Thoroughly qualitative and quantitative topography, microstructure, splats formation and phases evaluation were made to understand carefully the behavior of plasma sprayed zirconia-ceria-yttria coatings processed under near optimum processing conditions. The study is focused on how to design and select the given property to predict the reliable data of plasma sprayed zirconia-20 wt% CeO₂-3.6 wt% Y₂O₃. The processing and plasma spraying parameters were designed carefully to give a reliable clear evaluation of the microstructure. The results showed a heterogeneous microstructure in which melted, semimelted and unmelted particles were existed. The phases formed are consisted of nontransformable tetragonal phase (t’) with small amount (less than 2 mole%) of monoclinic phase (m). The electron probe microanalysis (EPMA) suggests the intimate mixing between the binary systems of zirconia-ceria and zirconia-yttria during spraying. The Image J technique, SEM, EPMA, EDS and XRD/step scan XRD were used collectively to build up a clear picture on the solidification mechanism of the new plasma sprayed coating system.

Keywords— Plasma sprayed ceramic; Zirconia-ceria-yttria; Advanced engines; Electron probe microanalysis

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