



Kaito Takagi, TOCALO Co., Ltd

***Microstructural Control and Functional Properties of Columnar YSZ Coatings Deposited by Suspension Plasma Spraying***

**Abstract:**

Columnar yttria-stabilized zirconia coatings deposited by suspension plasma spraying are expected to exhibit extended thermal cycle lifetimes because vertical gaps within the coating mitigate thermal strain. Consequently, their application to thermal barrier coatings has been extensively studied. With recent advancements toward higher temperatures and efficiencies in gas turbines, thermal cycling environments have become increasingly severe. Therefore, aiming to further enhance thermal cycle resistance, this study focused on the effects of spray parameters on the columnar structure and its formation mechanism. Experimental results revealed that the interior of a single column consists of alternating dense layers formed by straight-flying particles and porous layers formed by particles following the gas stream. Under conditions with higher particle velocities, the intercolumnar gaps narrowed, and the interior of the columns became more densified. These coatings demonstrated superior thermal cycle resistance and wear resistance, suggesting high interparticle bonding strength. Conversely, lower particle velocity conditions led to a degradation in these properties. This was presumed to be due to an increased proportion of the porous layer within a single column resulting from a higher fraction of overspray particles, which led to a decrease in interparticle bonding strength and a consequent reduction in coating strength. This presentation reports in detail the effects of spraying parameters on the columnar structure, as well as on the coating microstructure, thermal cycle resistance, and wear resistance.