

Application of Ceramic on Internal Combustion Engine Components as Thermal Barrier

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ABSTRACT

In the cotemporary industrial applications, almost all the selection of materials is done based on the mechanical and thermal properties of the material. For the past three decades, thermal barrier coatings (TBC) played a key role in improving the efficiency, capability and durability of high temperature structural components such as those found in automotive and gas turbine engines. Functionally gradient materials (FGM) are improved composite thermal barrier coating material consisting of two quite different materials, one is engineering ceramics to withstand the extreme thermal loading from the severe temperature condition and the other is metal to reduce thermal expansion mismatch between the ceramic layer and the metal substrate as well as improve the structural rigidity. Recently, these (FGM) materials had received considerable attention in the academic research and technical application due to the special characteristics of this material such as high stiffness, high strength and high thermal stability in severe condition of thermal loading. The FGM thermal barrier system offered several advantages over its pure ceramic thermal barrier system counterpart due to the excellent ability of the former in thermal stresses reduction at higher temperatures than the latter. Therefore vivid understanding of the thermal and mechanical properties of these excellent materials is a key step in evaluating their performance under real operation.

For this reason much has been and is being done on the study and development of ceramics for use in automotive engine components working under severe temperature conditions and heavy loads due to their inherent thermal and mechanical properties. The objective of the study is to review the contributions of structural ceramics in the development and improvement of some of the major automotive engine components working under severe conditions of temperature. It is expected that the study will serve as a useful guide for the selection of materials which can withstand severe conditions of temperature and heavy loads for a novel of engine components application. Therefore, it is hoped that this presentation will serve as a useful guide in selecting the suitable ceramic material to be used as a component or as a coating for internal combustion engine.