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Nature inspired, multi-functional, damage tolerant thermal spray coatings

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Abstract

Design and fabrication of ceramic materials that simultaneously provide adequate strength and toughness is of importance in engineering applications. Nature has demonstrated it is feasible to achieve this duality in properties through a combination of materials and microstructural engineering. The nacreous layer within the abalone shell is perhaps the most notable demonstration of such combined properties through unique combination of ceramic and polymeric material in an ordered, layered assembly. Recent studies have shown that through appropriate control of thermal spray processes and post-spray polymer infiltration of the deposited ceramic, it is possible, to some extent, to harness nacre's microstructural attributes resulting in the material's dramatic improvement in both strength and toughness. This paper seeks to build upon previous work of layered, natural inspired design seen in nacreous materials, with an emphasis on abrasion and contact damages. Two distinct thermal spray ceramic templates, one nacreous analogue and one standard thermal spray template, have been reproduced here and evaluated with regards to their functional performance e.g. abrasive wear

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