Wenbo Yu et al., J Material Sci Eng 2016, 5:4(Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.040

Bio-inspired SiCf-reinforced Ti-intermetallic multi-layers composite: Synthesis, microstructure and mechanical properties

Wenbo Yu[1], Kai Zhu[1] and Yann Aman[2]
[1]Tsinghua University School of Material Science and Engineering, China
[2]Université Félix Houphouet Boigny - Abidjan, Côte d'Ivoire

In reference to the well-evolved outer keratin layer of the turtle shell composed of multi-layered collagen-fiber-reinforced layers, a bio-mimicking SiCf-reinforced Ti-intermetallic multi-layers was successfully fabricated. The initially Ti and Al foils were firmly bonded to each other through the formed intermetallic phases layers. Additionally, SiC fibers and Ti were connected by TiC compound formed through the reaction between Ti matrix and deposited C coating on SiC fibers. Along the longitudinal direction of the SiC fibers, the ultimate tensile, flexural strengths and fracture toughnesses of the hybrid composite have increased of 53%, 105% and 70%, compared to the Ti-intermetallic multi-layers composite. In situ observation indicated that cracks were always initiated in the intermetallic region, the crack propagating paths are significantly changed and the length of cracks is visibly prolonged through crack deflection and crack blunting. Due to the strong interfacial connection between SiC fibers and Ti matrix through a circular joining of TiC, the broken SiCf pieces could strengthen the Ti matrix. Herein, the curve of hybrid composite presents one long plateau after the yield point, other than the Ti-Al intermetallic multilayers. Therefore, due to these mechanisms, the bio-mimicking hybrid composite shows an excellent damage resistance.

Biography

Wenbo Yu has completed his PhD from Universite de Poitiers and Post-doctoral studies from Tsinghua University School of Material Science and Engineering. He has published more than 9 papers in reputed journals. He mainly works on MAX phases and SiCf reinforced composite.

wenboyu@mail.tsinghua.edu.cn

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