Carbon nanotubes as reinforcing phase in metal matrix nanocomposites. Tailoring the material's microstructure and its physical characteristics.

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Abstract

Carbon nanotubes (CNT) have attracted significant interest from materials engineers in the past two decades due to their interesting intrinsic physical properties. Theoretically, they possess very high thermal and electrical conductivity and mechanical strength, mainly due to their sp^2 hybridization. However, their large specific surface makes them prone to agglomeration, which acts detrimentally on their applicability as a reinforcement in composites materials. This work focuses on an approach to integrate CNT into metallic matrices, obtaining seamless carbon-metal interfaces and a very good reinforcement distribution. The resulting microstructure and the overall physical characteristics after the solid state processing of these composites will be discussed as well as their mechanical and tribological performance, ranging from the basic composite design to a bearing prototype testing. It has been observed significant improvements in the composite hardness, friction reduction, wear resistance and thermal stability, driven by the effect of the addition of CNT on the microstructural tailoring of the matrix. This composites may find their application field in systems subjected to tribo-chemical environments.