Bioinspired Graphene-Copper Matrix Nanocomposites

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Metals can be strengthened by adding hard reinforcements, but such strategy usually compromises ductility and toughness. Natural nacre consists of hard and soft phases organized in a regular ‘brick-and-mortar’ structure and exhibits a superior combination of mechanical strength and toughness,[1] which is an attractive model for strengthening and toughening artificial composites, but such bioinspired metal matrix composite has yet to be made. Here we prepared nacre-like reduced graphene oxide (RGrO) reinforced Cu matrix composite based on a preform impregnation process, by which two-dimensional RGrO was used as ‘brick’ and inserted into ‘☐-and-mortar’ ordered porous Cu preform (the symbol ‘☐’ means the absence of ‘brick’), followed by compacting.[2] This process realized uniform dispersion and alignment of RGrO in Cu matrix simultaneously. The RGrO-and-Cu artificial nacres exhibited simultaneous enhancement on yield strength and ductility as well as increased modulus, attributed to RGrO strengthening, effective crack deflection and a possible combined failure mode of RGrO. The artificial nacres also showed significantly higher strengthening efficiency than other conventional Cu matrix composites, which might be related to the alignment of RGrO.

References
