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SUPPORTING INFORMATION

On the influence of carbide coating on the thermal conductivity and flexural strength of X (X=SiC, TiC) coated graphite/Al composites

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SUPPLEMENT

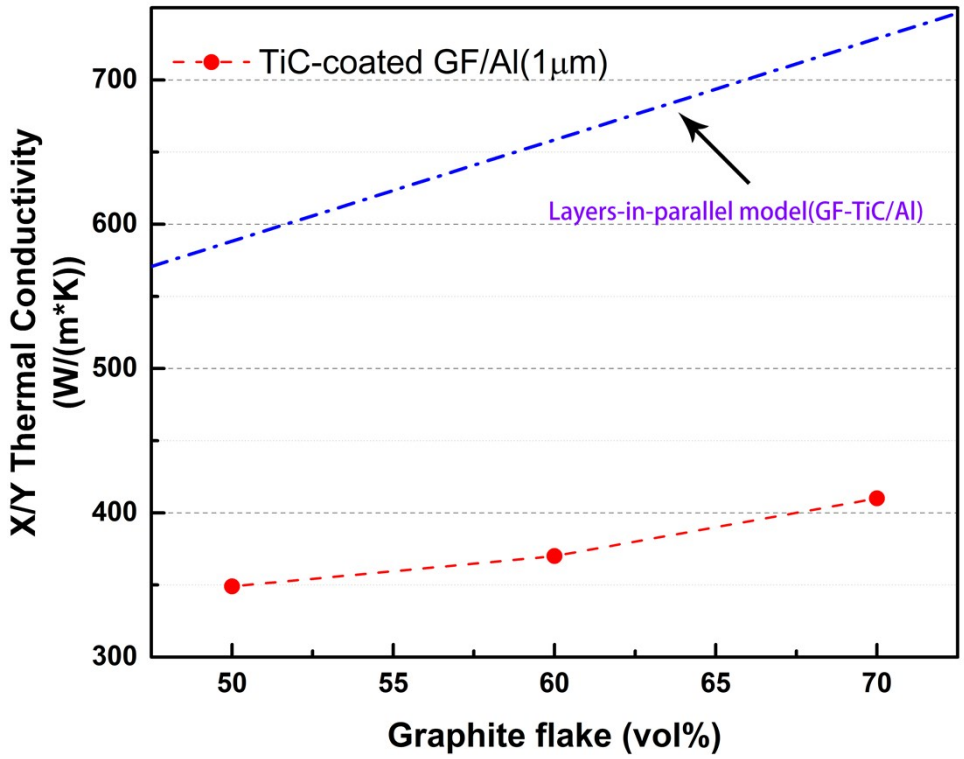

Fig. S1. Thermal conductivity of TiC coated GF/Al composites

Fig. 1S shows the thermal conductivity of TiC-coated GF composites calculated by the layers-in-parallel model predictions compared with the experimental values**.** And the predictions calculated by the layers-in-parallel model are higher than the experimental data. The value of h is calculated by the AMM, calculated as follows:

$$h \cong \frac{1}{2}\rho_m C_m \frac{v_m^3}{v_i^2}\frac{\rho_m v_m \rho_i v_i}{(\rho_m v_m + \rho_i v_i)^2}$$

Due to the lack of data, the phonon velocity of TiC can be derived by $v = \sqrt{B/\rho}$, where B is the bulk modulus taken as 250GPa for TiC.[1, 2] The density and specific heat of TiC are taken as 4930 kg m^{-3} and 568 J kg^{-1} K^{-1}, respectively.[3] And the TiC layer is referred to as the inclusion for the Al/TiC layer and as the matrix for the TiC/graphite layer. The calculated results is $h_{Al/TiC}$ = 1.8785 × 10^8 Wm^{-2} K^{-1} and $h_{TiC/graphite}$=5.767×$10^8$$Wm^{-2}$ K^{-1}, respectively. The total interfacial thermal conductance (h) of the TiC coated graphite/Al composite can be determined as follows:

$$\frac{1}{h}=\frac{1}{h_{Al/TiC}}+\frac{1}{h_{TiC/graphite}}+\frac{d_{TiC}}{K_{TiC}}$$

Assuming K_{TiC}=36.4 W/(m·K),[3] d is measured by FIB and the thickness of coating layer is about 329 nm. The total h=$6.212\times10^{7}$$Wm^{-2}$ K^{-1}. Assuming K_m=237 W/(m·K), K_f=1000 W/(m·K), the effective thermal conductivity, is calculated to be 939.5 W/(m·K) for the TiC-GF/Al composite, which is much more than the experimental data, demonstrating that the layers-in-parallel model is not applicable for TiC-coated GF/Al composites.

Reference

1 V. Moruzzi, J. Janak, K. Schwarz, *Phys. Rec. B*, 1988, **37**, 790.

2 R. Ahuja, O. Eriksson, J. Wills, B. Johansson, *Phy. Rev. B*, 1996, **53**, 3072.

3 Y. Zhang, H. L. Zhang, J. H. Wu, X. T. Wang, *Scr. Mater.*, 2011, **65**, 1097.